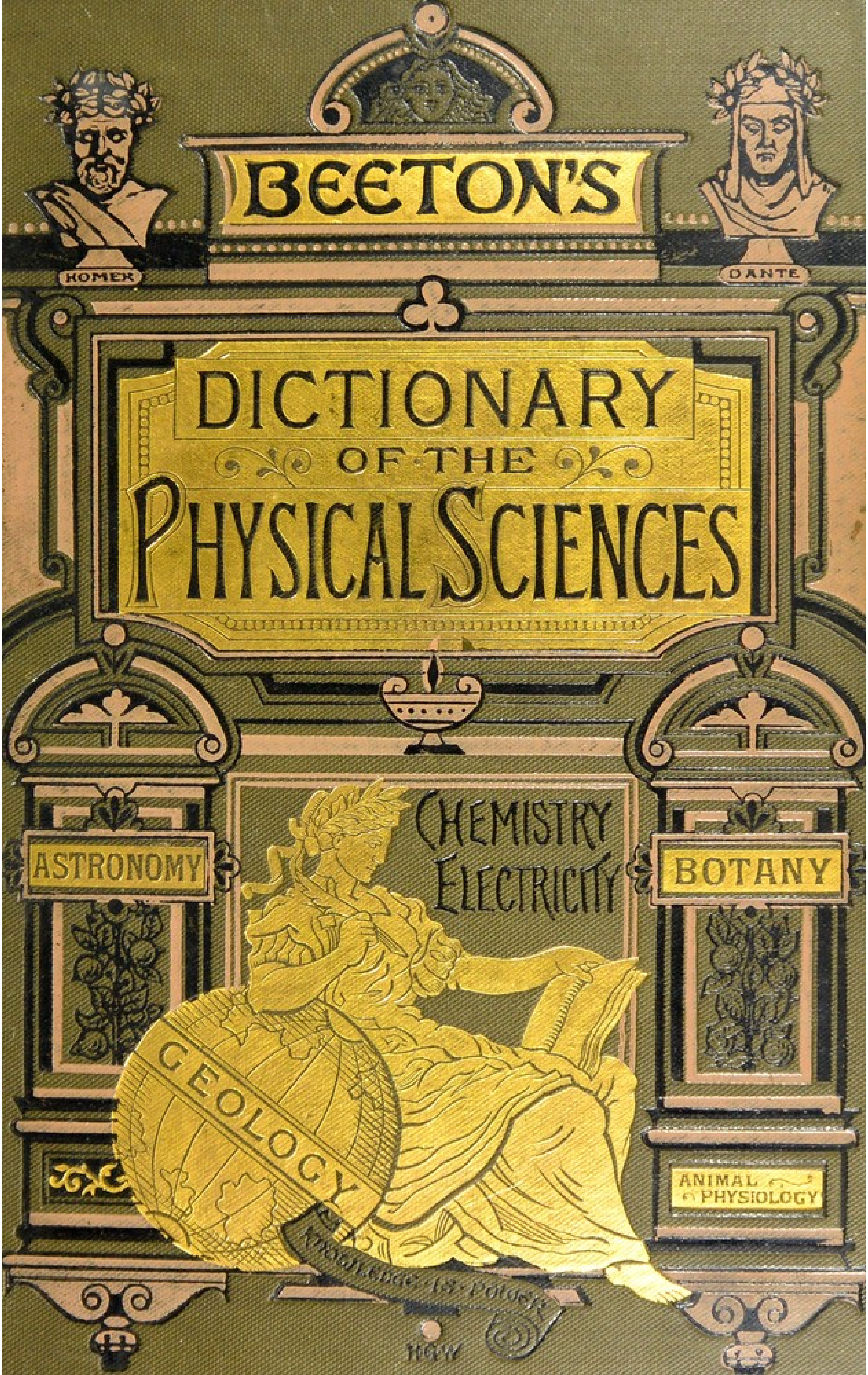
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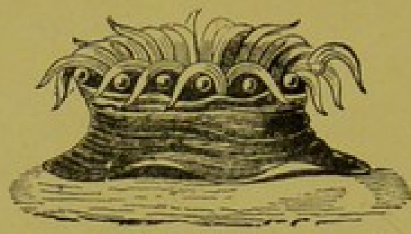
ACACIA NILOTICA.



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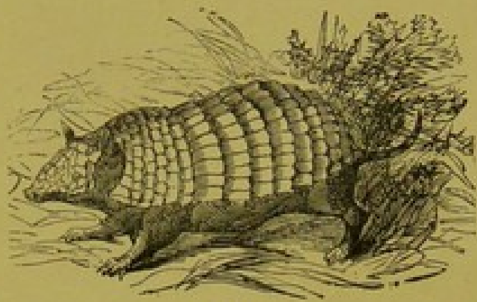

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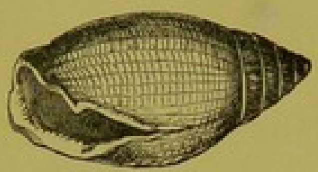

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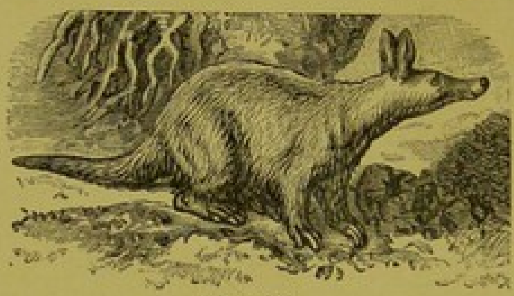

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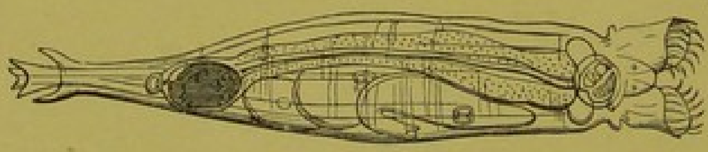
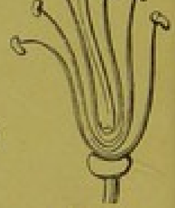
AXOLOTL.



WHEEL ANIMALCULE.

APPLE BLOSSOM.



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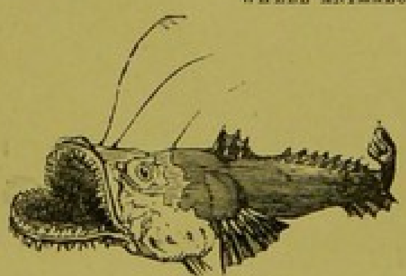

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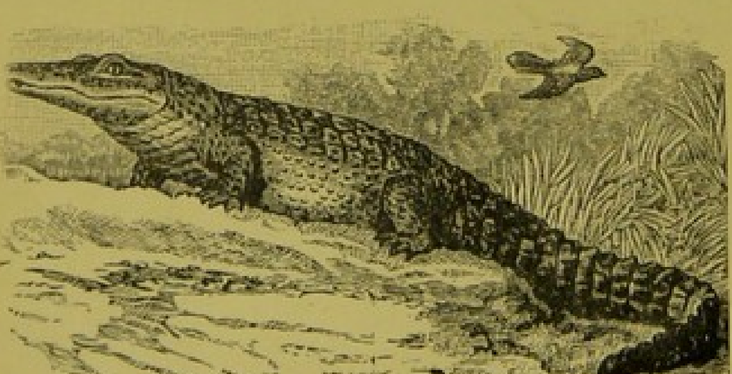

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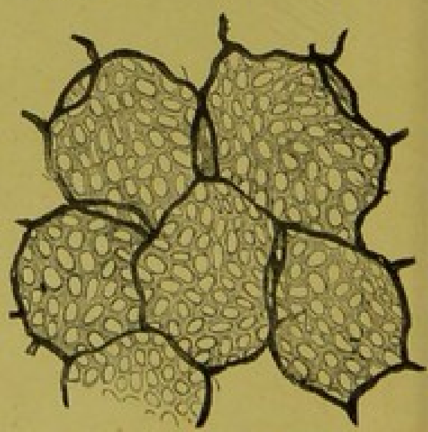

AIR-CELLS OF THE LUNGS.

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PREFACE.

In a Dictionary whose object is to elucidate the Physical Sciences, there are various points of great importance, which must be studiously kept in view, if the Editor's task is to be worthily performed, and the book is to take, and to hold its place, as a standard work of reference on the subjects that it includes. The field of the Physical Sciences is so vast—the inventions of the present age are so numerous and startling—processes and methods become so quickly obsolete, as they are replaced by new and more effective means towards the desired ends—that continual vigilance and industry are requisite in the preparation of such a book, lest essential matters should be omitted, and the work should thus fall short of completeness, as a repertory of useful knowledge, which may be at all times consulted, with complete confidence in its fulness and accuracy.

In this Dictionary, accordingly, most anxious care has been bestowed in bringing the information up to the present time, adding such novelties as may have accumulated in the various departments, and rendering complete the articles treating of subjects that have undergone the greatest change within the last few years. Scientific knowledge teaching and processes have in these latter times made gigantic strides, and new theories, methods and operations have taken the place of the time-honoured and old. Scientific principles that were formerly merely matter of conjecture, have been carried into practical adaptation, and increase the comforts and conveniences of every-day life. The electric light, for instance, is an outcome of the scientific advance of the last few years, and has already changed from an ingenious toy to a practical and widely used method of illumination. In these days, the aspect of the world has been changed, partly by the results of travel undertaken by the pioneers of discovery and civilisation, partly by the political changes that have altered the boundaries of existing states, and created new governments and principalities; and in no small measure also, by the healthy spirit of enterprise and adventure, the colonising and empire-spreading instinct of the Anglo-Saxon race, that has caused thriving communities to spring up, where a few years since there were wide uninhabited plains or regions sparsely occupied by insignificant villages or habitations widely distant from each other. All this activity could not fail to have a most important influence on the advance of knowledge, and the processes of experimental and practical science.

These changes necessitate the introduction of a large number of new articles in a Dictionary of the Physical Sciences, and the very careful preparation of the whole. Science and its applications, naturally make large demands upon the care of the editor, in a work of this kind. Electricity, Telegraphic and Telephonic communications, Railways, Steam Navigation, and the various kindred subjects will be found treated in this book, in a manner which, while thoroughly intelligible to the attentive though unscientific reader, gives complete and unduly condensed information with due consideration of technical detail.

Throughout the whole work, in the writing and preparation, and the apportioning of space to the various articles, the object kept steadily in view has been to give the greatest possible amount of accurate information that could be compressed into the space, and to make it in every respect a valuable and trustworthy book of reference. Some pardonable pride may be allowed in recording that the opinions of the press and the suffrage of many thousands of readers have already been given in favour of various works of universal utility in various departments of knowledge, that comprise the series of Beeton's practical reference books; and it is hoped that the present work, prepared as it is with anxious care for accuracy and completeness, will be found not unworthy of taking rank with its predecessors, and will make good its claim to the favour of the people of the British Empire, throughout the world.

BEETON'S

DICTIONARY OF SCIENCE AND NATURAL HISTORY.

AARD-WOLF, *ard'-woolf* (Du., earth-wolf), a genus of digitigrade carnivorous mammals forming the link which connects the civets with the dogs and hyænas. It is a rare and singular animal, having externally the appearance and bone-structure of the hyæna united to the head and feet of the fox, with the intestines of the civet. Its size is about that of a full-grown fox; its habits are nocturnal, and it constructs a subterraneous abode.

AARD-VARK, *ard'-vark* (Du., earth-pig), in Zool., a genus of animals which belongs to the class *Mammalia*, order *Edentata*, genus *Orycteropus* (of which it is the only known species). It feeds upon insects and roots, and burrows in the ground. It is about three feet long, with very short legs, nocturnal in its habits, and passes the greater portion of its time in eating and sleeping. It lives entirely upon ants. The name was given by the Dutch at the Cape of Good Hope. The flesh of the aard-vark is eaten, and even considered, when preserved, a delicacy.

ABAX, *a'-bax*, in entomology, a genus of coleopterous insects.

ABDOMEN, *ab-do'men* (Lat., *abdo*, I hide), in Anat., the belly, or lower part of the trunk, separated from the chest or upper part by the diaphragm. It contains the stomach, intestines, liver, spleen, pancreas, kidneys, &c., and is lined within by a membrane called the peritoneum. For convenience of description, the abdomen is divided horizontally into three regions—the upper or epigastric; the middle, or umbilical; and the lower, or hypogastric. It may also be divided longitudinally by two lines, when the above terms are confined to the central portion, the epigastric having on each side the right and left hypochondriac; the umbilical, the right and left lumbar; and the hypogastric, the right and left iliac.

In Ent., the whole lower portion of the body of an insect consisting of a number of rings or segments, frequently nine, more or less distinct from each other.

ABDOMINALES, or ABDOMINAL FISHES, *ab-dom-i-nai'lees*, the fourth class of animals in the Linnæan system. *Charac.* Ventral fins (those of the belly) placed behind the pectoral, (those of the breast) in the abdomen, and the branchiæ or gills ossiculated. The arrangement of Linnæus is now, however, generally discarded, the term abdominales denoting a subdivision of the *Malacopterygii*, or soft rayed osseous fishes. Carp, salmon, trout, herring, and pike, are familiar specimens.

ABDUCTOR MUSCLES, *ab-duk'-tor*, a term given in Anatomy to those muscles which draw one part of the body from another; as *adductor* muscles are those which draw one part of the body to another.

ABELE-TREE, *ab-ee'-le*, in Bot. called the *Populus alba*, a species of the poplar, having very large leaves.

ABELIA, *a-be'-li-a*, in Bot. a genus of pretty flowering plants belonging to the order *Caprifoliaceæ*, and named from Dr. Abel, a botanist attached to the embassy at China.

ABELMESAK, *a-bel-me'-sak*, the musk-seed, which grows in the West Indies and in Egypt, and is used as a perfume.

ABELMOSCHUS, *a-bel-mos'-kus*. (See Hibiscus.)

ABERDEVINE, *ab'-er-de-vine*, (*Fringilla Spinus*), a song-bird, sometimes called the Siskin, included in the genus *Carduelis*. It resembles the goldfinch, but is rather smaller and less elongated. The crown of the head and the throat are black, and the prevailing colour of the body is dusky green. It is often paired with the canary, to produce what are called mule birds. In its habits it is migratory, breeding in the north of Europe, and visiting Germany, France, and Britain only in the autumn and winter.

ABERRATION, *ab-er-ai'-shun* (Lat., *ab*, from, and *erro*, I wander), a term applied to three highly-important optical phenomena:—

Aberration of Light (or aberration of celestial bodies) designates a small apparent displacement of the fixed stars. It arises from these combined causes—the progressive movement of light (travelling at the rate of 195,000 miles per second), and the movement of the earth in her orbit, by which the eye of the observer is being carried onwards during the time that light takes to travel from the star to the earth. Its effect is to give the fixed stars an apparent movement in space around their true place. The discovery of this remarkable fact was made in 1727, by Dr. Bradley; and it is one that affords an incontrovertible proof of the motion of the earth around the sun.

Aberration of Sphericity designates that deviation of the rays of light which takes place after they have passed through a curved lens, whereby the rays, instead of being collected into a single point, are extended over a small space; thus giving a rather confused image of the object. This deviation is due to the spherical form of the lens itself.

Aberration of Refrangibility is the term applied to that dispersion of the rays of light which happens after they have passed through a lenticular glass, and in consequence of which a variegated ring of colour is seen encircling the image, and thereby rendering it a confused one. This defect has, however, been remedied by the invention of achromatic lenses. (*See* ACHROMATIC.)

ABIES, *ai'-bi-ees* (Lat., *abies*, the fir-tree), in Bot., a genus of plants included in the natural order *Coniferæ*, or cone-bearing family. (*See* CONIFERÆ). They are generally divided into four classes, with the following distinct characters:— 1. Leaves growing singly round the branches, and all turned towards one side (*silvers*); 2. Leaves growing singly round the branches, and all growing equally (*spruces*); 3. Leaves growing in clusters, deciduous (*larches*); 4. Leaves growing in clusters, evergreen (*cedars*). Several species of this genus are valuable timber-trees; as *Abies excelsa*, the spruce fir; *A. alba*, the white spruce; and *A. canadensis*, the hemlock spruce. The resins and gum-resins which these trees exude are extensively used in the arts. The spruce fir produces common frankincense, from which Burgundy pitch is prepared; the balm of Gilead fir (*A. balsamea*) yields Canada balsam; the silver fir (*A. picea*), Strasburg turpentine; and the common larch (*A larix*), Venice turpentine. Essence of spruce, used in the preparation of spruce beer, is formed by boiling the shoots of *A. nigra*, and some other species, in water, and afterwards concentrating the decoction.

ABIETINE, *ai-bi'-e-tine* (Lat., *abietarius*, connected with firs), the neutral resin obtained from Strasburg turpentine and Canada balsam. It is insoluble in water, but soluble in alcohol.

ABIETINEÆ. (*See* CONIFERÆ.)

ABILGAARDIA, *ab'-il-ga-ar'-di-a*, a genus of plants belonging to the order *Cyperaceæ*, and named after Professor Abilgaard, of Copenhagen.

ABIOGENESIS, *ab'-i-o-gen'-e-sis*, a term used by modern biologists, to indicate the production of living from inanimate matter. It was first used by Professor Huxley, to replace the older, but less definite phrase, "spontaneous generation." It is the opposite of Biogenesis, or "derived from life." (*See* BIOLOGY.)

ABLANIA, *ab-la'-ni-a*, a genus of arboreous plants, belonging to the order Tiliaceæ; natives of Guiana.

ABLEPSY, *ab'-lep-se* (from a Greek word signifying blindness), in pathology, defect of sight, blindness.

ABLUENT MEDICINE, *ab-loo'-ent* (Lat., *abluo*, I wash away), a term formerly applied to those medicines which are used for purifying the blood.

ABNORMAL, *ab-nor'-mal* (Lat. *ab*, from, and *norma*, a rule), in Bot., a term applied to aërial roots, like those of the mangrove, which help to support the stem.

ABOMA, *a-bo'-ma*, a species of large serpent inhabiting the morasses of South America. (*See* BOA.)

ABOMASUM, *ab-om-a'-sum*, the fourth stomach of ruminating animals, in which the food is converted into chyme, after being macerated and ground down in the first three stomachs. (*See* DIGESTION.)

ABORTIVE, *a-bor'-tiv*. In Bot., the essential part of the stamen is the anther, and when this is absent the stamen is said to be abortive. The general term abortion is applied to the suppression or new development of any organ.

ABOU-HANNES, *a-boo-'han'-nes*, an African bird (*Ibis religiosa*, Cuvier), identical with the ancient ibis. Although solitary in its habits, it is sometimes seen in small bands of from six to ten, and is capable of a lofty and powerful flight. It has some resemblance to the curlew found in Britain, but has not been observed to run. In Egypt it is called by the inhabitants *Abou-Menzel*, which literally signifies "Father Sickle-bill," from the curved resemblance which it bears to that implement. The Ethiopic name, however, is *Abou-Hannes*, which means "Father John," and which, according to M. Dumont, is applied to it because it arrives in Ethiopia about the day of St. John.

ABRAMIS, *a-brai'-mis* (Gr. *abramis*) a sub-genus of the *Malacopterygii*, including the bream. (*See* ABDOMINALES.)

ABRANCHIANS, *ab-ran'-ke-ans* (Gr., *a*, without, and *branchia*, gills), an order of Anellidians, so called because they possess no organs of respiration. (*See* ANELLIDIANS.)

ABRAXAS, a genus of nocturnal *Lepidoptera*, in which is included the common magpie-moth. Its colour is a yellowish white clotted with black, and a band of pale orange marks the wings. It deposits its eggs on the leaves of the currant and gooseberry in July or August, and the caterpillars are hatched in September. Its chrysalis is black.

ABRAZITE, *ab'-ra-zite*, from a Greek word signifying "without bubbles," a mineral which does not effervesce when liquefied before the blow-pipe.

ABROMA, *ab-ro'-ma*, in Bot., a genus of tropical plants in the *Byttneriaceæ*, or Chocolate order.

ABRUPT, *ab-rupt'* (Lat., *abrumpo*, I break off), in Bot., a term applied to any main root which ends abruptly, as though the point had been bitten off.

ABRUS, *ai'-brus* (Gr., *abros*, elegant), in Bot., a genus of leguminous plants, sub-order *Papilionaceæ*. The seeds of the *Abrus precatorius*, common in tropical regions, are used as beads: they are about the size of a pea, of a bright scarlet colour, with a black mark on one side. The roots possess properties exactly similar to those of the common liquorice.

ABSCESS, *ab'sess* (Lat., *abscedo*, I separate), the name given in Surg. to an accumulation of pus, or matter, in some tissue or organ of the human body. The pus is formed from the blood during the process of inflammation, and the production of it is termed suppuration. When an opening is formed in an abscess, and matter still continues to be discharged from it, it is styled an ulcer. There are few tissues or organs of the body in which abscesses may not form. Abscesses in some organs are comparatively unimportant; in others they are highly dangerous. In the early stage, abscesses are treated by the application of warm bandages or poultices.

ABSCISS, OR ABSCISSA, *ab-siss'-a* (Lat., *abscindo*, I cut off), in Geom., a term signifying a segment cut off from a right line by an ordinate to a curve.

ABSINTHINE, *ab-sin'-thene*, a crystalline principle obtained from the *Artemisia Absinthium*, or wormwood. (*See* ARTEMISIA.)

ABSORBENTS, *ab-sorb'-ents* (Lat., *absorbeo*, I suck up), a name given in Anat. to certain small delicate vessels which imbibe fluids that come in contact with them, and carry them into the blood. (*See* LACTEALS and LYMPHATICS.)

In Med., substances used to absorb or neutralize the acids sometimes formed in the stomach: chalk and magnesia are examples. In Surg., spongy substances used in dressing wounds, such as lint and AMADOU (German tinder).

ABSORPTION, *ab-sorp'-shun*, is the interpenetration of certain bodies by other bodies or influences, which by this means disappear or become lost. There are several important examples of this in Physics.

In Bot., the chief function of the root by which food is taken up in a state of solution for the uses of the plant. (*See* ENDOSMOSE.) The leaves of plants absorb carbonic acid gas and fluids.

In Chem., the disappearance of a gaseous fluid on entering into combination with a liquid or solid; thus, when the gas, ammonia, is passed into water, absorption takes place, and the result is the liquid commonly called spirits of hartshorn.

In Physiol., a term employed to designate that natural function of the body which is exercised by the absorbent vessels; as the absorption of the chyle by the lacteal vessels.

Of Heat, is where the heat-rays seem to disappear within the substances of bodies subjected to their influence, the effects differing greatly according to surface and colour. As this subject is closely connected with the phenomena of radiation and reflection, it will be considered at greater length under the article HEAT. (*See* HEAT.)

Of Light, will be best explained by considering the causes of transparency, opacity, and colour. Transparency in a body is caused by one part of the light striking on it being transmitted through its substance, another being reflected from its surface, and a third being absorbed or lost in its interior. When a body reflects nearly the whole of the light, absorbing only a very small portion, it is said to be opaque. Colour is produced in transparent media by part of the colour contained in white light being absorbed. (*See* COLOUR and LIGHT.)

ABSTRACT SCIENCES (Lat., *abstraho*, I withdraw), those sciences, as pure mathematics, which deal with knowledge independent of its practical application (*See* ABSTRACTION.)

Abstract Mathematics, or Pure Mathematics, signifies that branch of the science which deals with magnitude, figure, and quantity in general, and without reference to any particular magnitude, figure, or quantity. Abstract Mathematics is opposed to Mixed Mathematics, which deals with the application of mathematics to navigation, astronomy, optics, &c.

Abstract Numbers, in Arith., a term which signifies numbers considered in themselves, and without being applied to any individual thing—as 4, 8, 12, &c.—in distinction from numbers applied, or in the concrete—as 4 men, 8 feet, 12 ships, &c.

ABSTRINGENT, from a Latin word meaning "unbinding," in pathology, a term applied to any medicine used for removing concretions or obstructions.

ABUNDANT NUMBERS, *a-bun'-dant*, in Arith., are those numbers the aliquot parts of which, added together, make more than the number itself: thus, the aliquot parts of 20 (1, 2, 4, 5, 10), on being added together, make 22. (*See* ALIQUOT PARTS.)

ABUTILON, *a-bu'-te-lon*, a genus of plants, belonging to the natural order *Malvaceæ*. The most interesting species is the *Abutilon esculentum*, commonly called Bençao de Deos, the flowers of which are boiled and eaten as vegetables in Brazil.

ACACIA, *a-kai'-she-a*, in Bot., a genus of plants, belonging to the natural order *Leguminosæ*, sub-order *Mimosæ*. Many kinds furnish good timber and valuable gums. Various species, natives of Africa and the south of Arabia, yield gum arabic; and the inner wood of the *A. Catechu*, an Indian shrub, affords a kind of catechu, or cutch, rich in tannin, which is used for tanning, and in medicine as an astringent. The pods of some of the Indian varieties are saponaceous and used in washing. The flowers of many species are fragrant.

ACÆNA, *a-see'-na*, from the Greek for a thorn, a genus of herbaceous plants, of the *Tetrandria-Monogynia* class. (*See* SANGUISORBACEÆ.)

ACÆNITUS, *a-see'-ni-tus*, a genus of insects of the tribe of ICHNEUMONIDES.

ACALEPHÆ, *a-ka-le'-fe* (Gr., *akalephe*, a nettle), a class of marine invertebrate animals, comprehended in the sub-kingdom *Radiata*, and otherwise called Sea-nettles. It embraces an extensive number of animals, of which the genus *Medusa* of Linnæus may be taken as the type. This genus has a nervous system and senses; a muscular system; a reproductive system and development; the power of stinging when touched; and is phosphorescent. *Acalephæ* have been separated into four families—the *Pulmograda*, the *Ciliograda*, the *Cirrhigrada*, and the *Physograda*. These families exhibit a great variety of genera of peculiar structure and form. Some of them are extremely beautiful. (*See* JELLY-FISH and MEDUSA.)

ACANTHACEÆ, *a-kan-thai'-se-e*, in Bot., the *Acanthus* order. Herbs or shrubs found in most parts of the world, and abounding in the tropics. There are nearly 1,400 known species, some having very beautiful flowers. The elegant lobed and sinuated leaves of the acanthus, which may be taken as the type of the order, are stated to have suggested the capital of the Corinthian pillar. (*See* ABACUS.)

ACANTHION, *a-kan'-the-on*, in Zool., a genus of *Rodentia*, known, at present, only by their osteology. The genus was established by Cuvier.

ACANTHOCEPHALA, *a-can'-tho-cef'-a-la* (from two Greek words meaning "spine-headed"), intestinal worms which attach themselves by means of curved spines. (*See* ENTOZOA.)

ACANTHODERMA, *a-kan-tho-der'-ma*, a fossil genus of fishes, from Glaris.

ACANTHODES, *a-kan-tho'-dees* (Gr., *akantha*, a point; *odous*, a tooth), a genus of fossil Ganoid fishes, found in carboniferous strata, near Edinburgh, Scotland.

ACANTHOPHIS, *a-kan'-tho-fis*, in Zool., a genus of venomous serpents, allied to the vipers. From these, however, they are distinguished by their having a single series of plates beneath the tail, except towards the very end of it, where, in some instances, they are separated into two small rows. They are viviparous, and conceal themselves among the roots of trees, depending for their prey on the effects of the poison with which they are imbued.

ACANTHOPHTERYGII, *a-kan-thof-te-ry'-ge-i*, one of the two primary divisions of osseous fishes, divided by Cuvier into fifteen families. They have spinous rays in the first portion of the dorsal fin, or in the first dorsal, if there are two. The bass, perch, gurnard, mackerel, and tunny belong to this division.

ACANTHURUS, *a-kan'-thu-rus*, a genus of fishes, of the order *Thoracici*, natives of the Indian and Arabian seas. The genus contains a large number of species, many of which are extremely beautiful in form and colour.

ACARUS, *ak'-a-rus* (Gr., *akari*, a mite), the tick or mite, the common mite found in dry provisions. There are many species, and it was an acarus which some years since M. Crosse supposed was produced by electricity. (*See* SPONTANEOUS GENERATION.)

ACAULESCENT, *a-kawl-es'-sent* (Gr., *a*, without, and *kaulos*, a stem), in Bot., a term applied to plants having very short or inconspicuous stems.

ACCELERATION, *ak-sel-le-rai'-shun* (Lat., *acceleratio*, hastening), is when the velocity of a moving body is continually increased. With whatever velocity a falling body moves in the first second, it will, at the end of two seconds, move with twice that velocity, and so on; the force of gravity increasing as the body approaches the earth. This is, however, practically modified, as a little time is lost through the increased density and consequent resistance of the air at each moment.

Of the Moon, is the apparent increase of the moon's velocity in her revolution round the earth. It is exceedingly slight, not more than ten seconds in a century, and is supposed to have been going on for about 141,000 years. It is due to the varying eccentricity of the earth's orbit.

Of the Stars, the time by which the fixed stars, in their transits over a meridian, anticipate the diurnal motion of the earth.

Of the Tides, are certain irregularities in the difference between the time of high water, which difference would be constant supposing the tides occurred at regular intervals. (*See* TIDES.)

ACCIPENSER, *ak-se-pen'-ser* (Lat., *acipenser*, a sturgeon), a genus of fishes, of the order of *Amphibia nantes*. It has a single linear nostril; the mouth is in the under part of the head, and without teeth; the filaments are below the snout, and before the mouth. There are three species of this genus—1. *Accipenser Huso*, the largest, is a native of Russia. The skin is so strong that it is used for traces in drawing vehicles. The isinglass of the shops is made from its sounds and scales.—2. *Accipenser Ruthenus* is also a native of Russia.—3. *Accipenser Sturio*, or the sturgeon, is frequent in our rivers. Isinglass is also made of the sounds of this fish. The sturgeon is sometimes found of the length of 18 feet, and weighing 700 lbs. It is oviparous, and spawns in water. (*See* ISINGLASS and STURIONIDÆ.)

ACCIPITRES, *ak-sip'-e-trees* (Lat., *accipiter*, a hawk), the Linnean name of an order of birds having eagles' crooked beaks and powerful talons. In this order are classed vultures, falcons, hawks, and owls. Later ornithologists prefer for the name of the order, RAPACES.

ACCLIMATIZE, *ak-kli'-ma-tize* (Lat., *ad*, to, and *clima*, a climate), to accustom an animal or plant to a climate not natural to it. A change of climate induces a certain change in the constitution of the individual, greater or less, according to the amount of difference between the two climates. In cases where the difference is extreme, diseases and even death may be the result. The change produced by acclimation may be either an improvement or a deterioration. Some plants or animals possess the power of bearing changes of climate to a much greater extent than others; and, frequently, a change which cannot be effected in one individual, may be brought about more gradually in the course of a few generations. The power of bearing changes of climate is remarkable in the human species, particularly in the Anglo-Saxon race. The Jewish race exhibits a remarkable facility for acclimatization. Next to man, the dog is the animal best adapted to change of climate.

ACCRESCENT, *ak-res'-sent*, in Bot., a term applied to a persistent calyx, that continues to grow after the flowering, so as to form a sort of bladder round the fruit.

ACCUMULATION, *ak-ku-mu-lai'-shun*, (Lat., *cumulus*, a heap), is that kind of motion existing in some kind of machines at the end of intervals of time during which the velocity of the moving body has been constantly accelerated.

ACCUMULATOR, an electrical machine which generates or accumulates, by means of friction, electric currents of high tension. It is an adaptation of the ordinary cylindrical frictional machine, and the exciting body consists of a large disc or circular plate of vulcanite, or "ebonite" as it is generally named by electricians.

ACEPHALA, *a-sef'-a-la*, from a Greek word for "headless." (*See* MOLLUSCA.) Also an order of insects. (*See* ENTOMOLOGY.)

ACEPHALOCYST, *a-sef'-a-los-ist* (Greek, "a headless bladder"), an intestinal parasite which has the appearance of a simple bladder without any visible organs. (*See* ENTOZOA.)

ACER, *ai'-ser* (Lat., sharp), in Bot., an important genus of the natural order *Aceraceæ*. Many useful and ornamental trees are included in this genus.—*Acer saccharinum*, the sugar-maple, yields a great portion of the sugar used in America. (*See* MAPLE.) *A. campestre* and *A. pseudo-platanus* are common timber-trees in Britain; the latter is commonly known as the sycamore.

ACERACEÆ, *ai-ser-ai'-se-e*, in Bot., the maple order. The plants of this order are handsome trees, which furnish light and beautiful wood, much used in the arts. They are also remarkable for their saccharine sap. They grow in the temperate regions of Europe, Asia, and North America. (*See* ACER.)

ACERANS, ACERA, *a-ser'-rans* (Gr., *a*, without, and *keras*, a horn), in Ent., a family of wingless insects.

ACERIC ACID, *a-ser'-ick* (Lat., *acer*, the maple), an acid obtained from the sap of the maple-tree.

ACETABULUM, *a-se-tab'-u-lum* (Lat., a small cup or dish), signifies, in Zool., the suckers of the arms of the cuttle-fish, as well as other dibranchiate cephalopods, which have on this account been termed acetabulifera.

In Anatomy, that deep cup-like cavity which receives the head of the femur, or thigh bone, thus forming the hip-joint.

In Entomology, the cavity in the trunk in which the leg is fitted.

ACETAL, *as'-e-tal*, in chemistry, a thin colourless fluid, boiling at 221° F., its specific gravity being ·821. It is one of the products of the slow oxidation of alcohol vapour under the influence of finely-divided platinum.

ACETARIOUS PLANTS, *a-se-tair'-e-us*, (Lat., *acetaria*, a salad), plants such as endive, mustard-and-cress, lettuce, &c., used for salads.

ACETATE, *a'-se-tait*, in Chem., a compound formed by the union of a base with acetic acid. Many of the acetates are of great importance in the arts. The most important is acetate or sugar of lead. All the acetates are soluble in water.

ACETIC ACID, *a-set'-ik*, in Chem., is produced by the oxidation or destructive distillation of organic bodies containing its elements—carbon, hydrogen, and oxygen. When pure, it is a colourless liquid of specific gravity 1·064, which crystallizes at a temperature below 60° F. It has a pungent smell, and is highly corrosive. Vinegar and pyroligneous acid are impure varieties of acetic acid. (*See* VINEGAR.) The crude acetic acid, known as pyroligneous acid, is one of the liquid products of the destructive distillation of wood. Oak and beech are the woods most commonly used in the manufacture, and the distillation is generally conducted in large iron cylinders. By a beautiful but tedious process, the acetic acid contained in the impure product is made to unite with soda, so as to form pure acetate of soda. This salt, when distilled with concentrated sulphuric acid, yields a colourless liquid, which is acetic acid. A portion of this crystallizes at a temperature of from 40° to 50° F., constituting what is called *glacial acetic acid*. The chemical composition of acetic acid is represented by the symbol $C_4H_4O_4$. Its uses are numerous and important. In the Arts, it is employed for the preparation of the various acetates, especially those of iron and alumina, which are the chief mordants of the calico-printer, for dissolving gums in making varnishes, and for photographic purposes. In Medicine, it is used externally as a local irritant, and internally as a febrifuge.

ACETONE, *a-se-tone'*, in Chem., a colourless volatile fluid, having the composition $C_6H_6O_2$, obtained by the distillation of the acetates of the alkaline earths. It has a peculiar odour, and is very inflammable. It is sometimes called *pyroacetic spirit*. As a remedy for asthma, it is occasionally used in medicine. In a pure state, it is a colourless mobile fluid which boils at 133° F.

ACETYL, *a'-se-til*, in Chem., a term applied to the supposed basis of vinegar and other acids. It is known also as Acetoxyl and Othyl.

ACETYLENE, *a'-set-e-leen*, a luminous hydrocarbon gas, resembling coal-gas, discovered by Berthelot, the eminent French chemist.

ACHENIUM, *a-ke'-ne-um*, in Bot., a one-seeded fruit, having a dry shell, or pericarp, which is closely applied to the seed, though separable from it. This pericarp is indehiscent, that is to say, it remains closed, and the seed can only become free by its decay. The little hard bodies scattered over the surface of the strawberry, and those we find clustered together in the centre of the buttercup, are achænia.

ACHATMA, *a-kat'-ma*, in Zool., a genus of terrestrial gastropods.

ACHERONTIA, *a-ke-ron'-she-a*, a genus of Lepidopterous insects, fam. *Sphingidæ*, which embraces some of the largest European Lepidoptera, the most remarkable of which is the *Acherontia atropos*, or Death's-head Hawk-moth (which *see*).

ACHILLEA, *a-kil'-le-a*, in Bot., a genus of plants belonging to the natural order *Compositæ*. The *Achillea Millefolium*, commonly called the Yarrow, or Milfoil, is the most important British species. Its white or rose-coloured flowers adorn many of our meadows, particularly those with silicious soils, from June to September. From these flowers an essential oil is obtained, and an infusion of the leaves and flowering heads is said to be a valuable stomachic. The leaves are in repute with some country people for healing wounds. The pretty garden plant known as white bachelor's buttons is a cultivated variety of a species of achillea. The familiar sneezewort and the aromatic genipp of the Alpine districts are other varieties. The generic name is derived from Achilles, who, in the Homeric legend, is said to have discovered the medicinal properties of the milfoil while studying botany under Chiron.

ACHILLES' TENDON, *a-kil'-lees ten'-don* (Lat., *tendo Achillis*), in Anat., a tendon which connects the muscles of the calf of the leg with the bone of the heel. It takes its name from the fable of the mother of Achilles dipping him in the river Styx to render him invulnerable. During this operation she held him by the heel, which was consequently untouched by the water, and there he subsequently received his death-wound.

ACHILLEUM, *a-kil'-le-um*, a genus of fossil *Spongiadæ*, of which there are two species found in the cretaceous strata of England. (*See* SPONGIADÆ.)

ACHLAMYDEOUS, *a-kla-mi'-de-us* (Gr., *a*, without, and *chlamus*, a cloak), in Bot., a term applied to flowers which have only stamens and pistils, the floral envelopes being wanting. The naked flower of the common ash is an example. This consists merely of the essential organs of reproduction, and has neither calyx nor corolla.

ACHRAS, *ak'-ras*, in Bot., a genus of plants belonging to the order *Sapotaceæ*, or *Sappodilla* family. They are natives of the tropical parts of India, Africa, and America. Several species yield luscious fruits; thus, the *A. sapota* produces the sapodilla plum, and the *A. mammosa* the marmalade. The barks of certain species are used medicinally in the treatment of fevers, and the milky juices of others yield substances resembling gutta-percha. (*See* SAPOTACEÆ.)

ACICULAR, *a-sik'-u-lar*, in Bot., a term signifying needle-shaped, applied to narrow leaves, like those of the fir. The term *linear* is more commonly used, and is to be preferred.

ACIDASPIS, *as-sid-as'-pis*, a genus of fossil *Crustacea*, of the group *Trilobites*, found in the Wenlock limestone.

ACIDIFIABLE BASES, *a-sid'-e-fi-a-bl*, in Chem., substances which are capable of being converted into acids; also termed *radicals*.

ACIDS, *as'-sid* (Lat., *acidus*, sour), a numerous and important class of chemical bodies, which are distinguished by the property of combining with alkaline bases to form salts, which have neither acid nor alkaline characters. (*See* BASE and SALTS.) Acids are generally sour to the taste; in most instances they have a great affinity for water, and are soluble in it; they redden nearly all the vegetable blues; they unite with metals or their oxides, alkalies, and earths. It was long held that oxygen was contained in all the acids. This element does indeed enter into the composition of the greatest number; but every true acid must contain hydrogen, and an acid is now commonly defined as a salt whose base is water. The acids furnished by the mineral kingdom are termed *mineral acids*. *Metallic acids* are formed by the combination of oxygen and a metal; and *organic acids* are those which contain carbon, or are formed with organic substances. (*See* CHEMICAL NOMENCLATURE.) The organic acids, which are very much more numerous than the mineral acids, and which all contain carbon and hydrogen, a large proportion oxygen, and some nitrogen, have no regular nomenclature. The most important of these chemical bodies are—among the mineral acids, sulphuric, sulphurous, hydrosulphuric, nitric, phosphoric, arsenious, arsenic, chromic, hydrofluoric, hydrochloric, chloric, iodic, carbonic, boracic, and silicic; among the organic acids, formic, hydrocyanic, oxalic, acetic, malic, tartaric, succinic, benzoic, citric, &c. (*See* these words.) Acids are extensively employed in medicine, principally in cases of inflammation, fever, palpitation of the heart, and irritation of the skin.

ACINACIFORM, *a-se-na'-se-form* (Lat., *acinaces*, a scimitar, and *forma*, form), in Bot., a term signifying scimitar-shaped; applied to certain succulent leaves.

ACINUS, *as'-e-nus*, in Bot., one of the divisions of the fruit of the raspberry.

ACONITE, *ak'-on-ite*, OR ACONITUM, *a-kon-i'-tum* (Greek, *akoniton*), in Bot., a genus of plants belonging to the natural order *Ranunculaceæ*, the Crowfoot or Buttercup family. Nearly all the species are poisonous; but when the extracts prepared from them are used in proper doses, their narcotic and diaphoretic effects prove highly beneficial. The flowers of many species are remarkable for their beauty, and resemble little helmets. The root of the *Aconitum ferox* is the principal source of the celebrated Indian poison, *bikh* or *bish*. The monkshood, *Aconitum Napellus*, is a native of Europe, and is cultivated as a garden plant for the sake of its handsome purple flowers. Preparations from this species are used in the treatment of neuralgia, acute rheumatism, and diseases of the heart. Its active principle is aconitine. The root of the *A. heterophyllum* is said to possess no poisonous properties, and to have a high reputation in India as a febrifuge and antiperiodic medicine.

Aconitine, or Aconitia, a powerful vegetable alkaloid, prepared from the root of the *Aconitum Napellus*. An ointment containing aconitine is often used in cases of neuralgia.

ACONTIA, *a-kon'-she-a* (Gr., *akon*, a dart), a genus of serpents established by Cuvier, and forming a link between the true serpents and the common snakes. Without bones; the usual lizard or serpent head; body covered with small scales only, but without the horny plates which guard its under surface in the common serpents; without poison-fangs, and with gentle habits; in general, of a small size, and it feeds on worms and insects. It is found in almost every part of the old world.

ACORN, *ai'-korn* (Sax., *aac*, an oak, and *cern*, grain), in Bot., the fruit of the oak-tree. (*See* QUERCUS.)

ACORN SHELL. (*See* BALANUS.)

ACORUS, *ai'-ko-rus* (Gr., *a*, without, and *kore*, pupil of the eye), in Bot., the sweet flag, a member of the natural order *Orontiaceæ*. This plant grows in watery places, and abounds in the rivers of Norfolk, whence the London market was formerly supplied. It blossoms during the months of May and June, and is the only truly aromatic plant growing wild in this country. The thick creeping stem or rhizome, commonly called the Calamus root, is the valuable part of the plant; it is somewhat spongy and powerfully aromatic, and has a bitterish taste. It is used by rectifiers to improve the flavour of gin, and is also employed to give a peculiar taste and fragrance to certain kinds of beer. Perfumers make use of it in the manufacture of hair-powder, and tanners in the preparation of peculiar sorts of leather. From the fresh rhizome a volatile oil is obtained by distillation, used in making aromatic vinegar, and for scenting snuff. In many parts of the continent, the root, cut into slices and prepared with sugar, is eaten as a sweetmeat. In Med., the sweet flag is sometimes used as an aromatic stimulant and a tonic, and many physicians speak highly of its beneficial effects in cases of ague. It grows in most parts of Europe, in Asia, and in the United States; and in Catholic countries it is used for strewing the churches at great festivals. It is supposed to be the *calamus* of the Song of Solomon: hence its botanical name, *Acorus Calamus*.

ACOTYLEDONS, ACOTYLEDONES, *ai'-ko-ti-lee'-dons* (Gr., *a*, without, *cotuledon*, seed-lobe), in Bot., are those plants which are propagated by spores, or cells, and not by true seeds. Cotyledons are the rudiments of the first leafy organs which make their appearance in the development of plants springing from seeds properly so called. These rudimentary organs do not exist in spores, which are accordingly said to be acotyledonous. Cryptogamous, or flowerless plants, are included in this great class, horsetails, pepperworts, club-mosses, mosses, liverworts, charas, lichens, fungi, and algæ.

ACOUCHI, *a-koo'-she*, is a small rodent animal very much resembling the agouti, but less in size. It is an inhabitant of the woods of Guiana, has only the rudiments of a tail, and subsists upon almonds, nuts, and other forms of vegetable food. (*See* AGOUTI.)

ACOUSTIC DUCT, *a-koo'-stik* (Greek, *akoúo*, to hear), in Anat., a term applied to the *meatus auditorius externus*, or external passage of the ear.

ACOUSTICS is the science which treats of the nature of sound, the laws regulating the production and the propagation of atmospheric or other vibrations in substances, solid or fluid. Sound is really a vibrating movement caused by putting the parts of an elastic body in rapid motion. When this is sufficiently rapid to strike the ear—that is, when the regular vibrations amount to about forty in a second—we hear what we term a harmonious sound, or musical note. Noise is a single blow inflicted on the ear, or an irregular motion of air particles. But, before the ear can have a perception of sound, it is necessary that some medium capable of vibration should exist, so as to transmit the vibrations to the brain. This "sounding body" is known to us as the "drum" of the ear, and the air is the conductor.

Take away the air, or alter its usual component parts, and the sounds previously audible will become indistinct. Newton showed that sound propagation depends upon the elasticity of the medium. Subsequent observations proved that when a force disturbs the particles in the atmosphere, or other body, they are moved to and fro, somewhat after the manner of a pendulum; these first moving particles strike other particles, causing them to vibrate also, so the "wave of sound" is created and travels on. This can be shown by the tuning fork. The prongs beat the air in opposite directions at the same time, and, as one prong strikes the air, it is driven away and condensed; the condensation then travels outwards, the prong recedes, beats back the air, and rarefies it on the first side. The rarefication and the condensation travel one behind the other at the same rate, and maintain the same relative positions. As the fork vibrates, each wave travels on with equal rapidity. Thus, if the fork makes one hundred vibrations in a second, at the end of that time the first sound-wave would have travelled, say, eleven hundred feet, and between the fork and the limit there would exist one hundred sound-waves, each eleven feet long. And so on, the quicker the vibrations, the less the wave length. Eleven hundred vibrations per second would produce eleven hundred waves, each a foot long; for, as we said above, sound-waves of all lengths travel at the same pace. When the vibrations of the air-particles take place at right angles to the direction in which the disturbance moves, the vibrations are said to be *transversal*. If moving in the same direction they are called *longitudinal*; but, of course, the vibrations may take place in any direction. The loudness usually diminishes as the distance increases between the hearer and the place where the sound originated, in consequence of the diminution in the density of the air; but Poisson states—and balloonists have verified the statement—that when *different* densities of air interpose between the ear and the sound source, the loudness of the sound heard depends upon the density of the air *at the source*. So, people in a balloon may and do hear sounds proceeding from the earth quite as distinctly as we upon the earth, at equal distances, hear the same sounds, while a faint sound from the balloon would be no louder, but not less loudly heard, on the ground, as when equi-distant in the air on a level with the balloon. Although air, from its being the medium most commonly in contact with the *membrana tympani* of the ear, is the most general conductor of sound, yet, other agents are capable of transmitting it. A bell rung under the waters of Lake Geneva was heard across the whole extent of the water, a distance of nine miles. With respect to its production in the air, Sir John Herschel has shown that, in round numbers, sounds of every intensity travel, at the temperature of 62° Fahr., at the rate of 1,125 feet per second, equal to $12\frac{3}{4}$ miles per minute, or 765 miles an hour. The velocity with which sound travels through different bodies varies greatly. The velocity of sound in air differs with temperature, and the rate of transmission, though different, varies considerably, being much slower through carbonic acid than through atmospheric air, and increasing in a fourfold proportion when passing through hydrogen. We need not here touch upon musical harmony farther than to mention the different qualities of sounds, which are *loudness*, *pitch*, and *timbre*. The first depends upon the *extent*, the latter, the *pitch*, on the rapidity of vibration. "Loudness is the violence with which the vibrating portions of the ear are excited." The *pitch* of a note is higher in proportion to the number of vibrations of the air in a given time—a second. *Timbre* is the different impression produced by similar sounds on different instruments—as the same note on a trumpet and on a flute. The intensity of sound is much augmented if the vibrations be confined in tubes and cavities of any kind. By means of a speaking-pipe, sounds, however slight, may be transmitted from one part of a building to another; whilst the stethescope conveys to the ear the slight sounds generated in the chest. The invention of the telephone and microphone have made a remarkable revolution in our sound-carrying instruments. Biot ascertained that the slightest sound can be heard through an iron pipe 3,120 feet in length. Sound is reflected like light, reflected sound being termed an echo. Some sounds are different only in intensity or loudness, as the reports of a musket and of a cannon; other sounds differ in musical pitch, as two notes from the same instrument; while others, again, are different in character of tone—what the French call *timbre*. We have seen that sound is produced by a certain vibratory force being transmitted through air, producing what is termed a wave of sound. The ear is designed to take cognisance, within certain limits, of these pulses of force, waves, or tremors. The nature of things prevents a single wave of sound from ever coming alone; the more nearly alone a wave comes, the more sharp and sudden the sound. When several nearly equal waves come at irregular intervals, the sound is called a noise. When the waves are equal and at equal distances, the sound is called a musical note. The middle C, between the bass and treble clef, is produced by waves about 8ft. 10 in. apart; waves at half that distance apart produce a tone one octave higher. If the distance apart of the waves of one note bears a simple ratio ($\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$, $\frac{3}{7}$, or $\frac{4}{7}$) to the distance apart of the waves of another note, the two notes harmonize; otherwise, they are discordant. The gravest musical sound is produced by about 16, and the sharpest by about 12,000 vibrations in a second. The sonorous vibrations of bodies are exceedingly curious, and the more difficult to be understood from our habits of measuring changes or motions by the sight; but these motions affect very sensibly another organ. The ear at once perceives the difference between a grave and an acute sound; but it is only from attentive observation by the eye that we discover the different rapidity of succession in the vibrations which produce them. The vibrations of a great many bodies, as strings, bells, and membranes, when emitting sounds, may, however, be distinctly seen, and even felt; but they may often be rendered more visible to the eye by a little artifice, such as sprinkling the vibrating body with sand, or some light granular substance. It was reserved for Ernest Chladni, a German of the last century, to contrive an apparatus for rendering sonorous vibrations visible, and his discoveries have proved of the greatest importance to the science of Acoustics. The idea was suggested to him of employing a violin bow to examine the vibrations of different sonorous bodies. When he applied the bow to a round plate of glass, fixed at its middle, it gave different sounds, which, compared with each other, were (as regards the number of their vibrations) equal to the squares of 2, 3, 4, 5, &c. The experiments on the electric figures formed on a plate of rosin, discovered by Lichtenberg, led him to presume that the different vibratory motions of a sonorous plate might also present different appearances if a little sand or some similar substance, were spread on the surface. These effects may be clearly shown by squares of plate glass. These plates may be held by a small wooden vice, or secured by a clamp in the centre. The edges of the plate must be smoothed by emery, and sand strewed upon them. On drawing the fiddle-bow across the edge of the plate, near one of its corners, the sand forms a figure in consequence of the vibration. This is the gravest tone, and the tone next to it in graveness is produced by applying the bow to the middle of one of the sides, upon which the sand is loosed away from certain parts of the surface and assumes another figure. By varying the points when the bow is applied, many beautiful figures may be produced. Dr. Tyndall, in one of his lectures upon sound at the Royal Institution, demonstrated that sound was really the consequence of waves in the air, or, in other words, that without air sound could not be propagated, by the following experiment. The professor placed a bell in the glass receiver of an air-pump; he then exhausted it of its atmospheric air. The bell was agitated, but gave out no sound. He allowed hydrogen gas, which is fourteen times lighter than air, to enter the receiver: the bell was scarcely heard to sound. On exhausting the receiver of the hydrogen gas, an almost perfect vacuum was obtained; the hammer was made to strike the bell violently, but, though a spectator placed his ear close to the glass vessel, not the faintest tinkle could be heard. The bell, in this instance, was suspended by strings; had it been placed upon the plate of the air-pump the vibrations would have been communicated to the air outside the receiver. When the atmospheric air was allowed to re-enter the vessel, a slight sound was at once heard, which, as the air became more dense, grew louder and and louder until the full sound of the bell was heard. The vibrations of a membrane may be well exhibited by stretching a piece of bladder over the mouth of a funnel and passing a horse-hair, retained by a knot, through its centre. By drawing the hair through the fingers, previously rubbed over with rosin, the membrane will be made to vibrate; and if sand or lycopodium be scattered on its surface, a symmetrical arrangement of the heavy particles at the nodal lines, as well as the accumulation of the light particles at the centres of vibration, may be observed. If a thin membrane be stretched on a triangular, square, or circular wooden frame, and strewed with sand, its vibrations will be readily excited by holding a tuning-fork, bell, or other vibrating body, near it, and they will be indicated by the motions of the particles of sand. French tracing-paper, or still better, thin parchment-paper (prepared by immersion in strong sulphuric acid), damped a little and attached by paste to the edges of the frame, will answer very well for these experiments.

ACRASY, *ak'-ra-se*, OR ACRATIA, *a-kra'-she-a*, (Greek "wanting strength"), in pathology the undue prevalence of one particular quality in the human constitution more than another; constitutional weakness of the body.

ACRIDIANS, ACRIDIA, *a-krid'-e-ans* (Gr., *akris*, a locust), a family of orthopterous insects.

ACRITES, ACRITA, *a-kri'-tees* (Gr., *akritos*, indiscernible), the simplest and lowest division of the animal kingdom, which embraces the *Infusoria*, *Rhizopoda*, and Sponges. (*See* these words.)

ACROCHORDUS, *ak-ro-kor'-dus*, a genus of serpents discovered in Java. The special characteristics are—head flat, and with the body covered with small scales; without poison-fangs, but possessing a double row of sharp-pointed teeth; throat capable of great extension; tongue thick and short; length from 8 to 10 feet. This serpent is supposed to eat fruit.

ACROGENÆ, *ak-ro'-je-ne* (Gr., *akros*, summit, *gennao*, I produce), in Bot., those acotyledonous or cryptogamous plants with visible stems and leaves. The stems of such plants are always acrogenous; that is to say, they grow only at their summits. (*See* STEM.) The tree ferns are examples. Various names have been given by botanists to plants of this class. This term is itself, however, only applicable literally to those plants which, destitute of flowers, possess a stem growing in a manner distinctive from those called Exogens and Endogens.

ACROLEIN, *ak'-ro-leen* (Lat., *acer*, sour; *oleum*, oil), in Chem., a highly volatile liquid produced by the action of heat on fat. Its vapour attacks the eye and the mucous membranæ of the nose most distressingly. It is composed of the elements carbon, hydrogen, and oxygen.

ACRONYCHAL, *ak-ron'-e-kal* (Gr., *akron*, and *nuktos*, of night), in Astron., applied to a star when it is opposite to the sun, or passes the meridian at midnight. A star is said to rise acronychally when it rises at sunset, and to set acronychally when it sets as the sun rises. Opposed to cosmical, which means rising or setting with the sun.

ACROPATHY, *a-krop'-a-the*, diseased action and pain at the extremities of the body.

ACROSALENIA, *a-kros-a-le'-ne-a*, a genus of fossil *Echinadermata*, occurring in the Isle of Sheppey.

ACROSPIRE, *ak-ros-pire'* (Gr., *akros*, *speira*, a spiral), in Bot., the sprout at the end of a seed which has commenced to germinate—the *plumule* of modern botanists. Maltsters use this term to express the growing of the barley.

ACROSTICHUM, *a-kros'-te-kum*, in Bot., a genus of ferns, of the *Polypody* sub-order. The species *Huacsaro* is used medicinally in Peru, and is much esteemed for its suderific, diuretic, and febrifugal properties.

ACROTEMNUS, *a-kro-tem'-nus*, a genus of fossil Ganoid fishes. One species is found in the chalk of Sussex.

ACROTERIA, *a-kro-te'-rea* (Gr., *akroterion*, the extremity of anything), in Architecture, a statue or ornament of any kind placed on the apex of a pediment.

ACTÆÆ, *ak tee'-e*, in Bot., a tribe of plants belonging to the Buttercup order, or *Ranunculaceæ*. They have elegant flowers and succulent fruits. The most important species is the *Podophyllum pelatum*, the May-apple or wild lemon of North America, which is employed in medicine, and has a very powerful cathartic effect. The active principle has lately been isolated, and is termed *Podophyllin*.

ACTINIA, *ac-tin'-i-a.* (Gr., *aktin*, a ray), in Zool., a genus of Polypes. (*See* CŒLENTERATA.) There are many British species, which are commonly known as *sea anemones*, from their resemblance to flowers. They are found on all rocky coasts, and they form the chief attraction of the marine aquarium. The body is conical or cylindrical, adhering to the rock by a broad disc-like base. The mouth, which is a simple opening into the internal cavity serving as a stomach, is surrounded by numerous tentacles which are often beautifully marked. These organs are retractile, and, when not covered by water, the actinia appears as a smooth hemispherical lump of elastic matter, sometimes of a brilliant colour. The reproductive power of these plant-like animals is very great, for when one is cut across, new tentacles form in a few weeks on the lower half, and each piece becomes a perfect creature. They are very sensitive to light. In many parts of the world they are eaten and considered a delicacy.

ACTINISM, *ak'-tin-ism*, the chemical principle of light. Three distinct principles emanate from the sun—light, heat, and actinism. It is actinism which fades colours, bleaches linen, rots fabrics, tans the human skin, puts out the fire, and performs the operations of photography. It acts principally by abstracting oxygen from the bodies which it affects. Fire is extinguished by sunlight through the diminution of the amount of oxygen necessary for combustion; and photographic operations are mostly affected by the reduction of oxide of silver to the metallic state, by the abstraction of its oxygen. We may have actinism without light, or *vice versâ*. Yellow glass transmits the latter, but stops the former. Hence, the photographer works in a yellow light. Dark blue glass, which transmits but little light, is quite pervious to actinism. Blue objects reflect great quantities of it, while red or yellow ones reflect but little or none. For this reason, in photographs, red or yellow materials are always too dark, while blue ones are too light. The electric and lime lights give out great quantities of actinism, from their blue tinge; and gas and candles but very little, from their yellow colour. The amount of actinism received from the sun differs considerably, according to the time of year, being at its maximum about the end of March, and gradually diminishing until the end of December, when it arrives at its minimum. Actinism in large quantities is necessary to the proper condition of the human system. It has been noticed that when dark rooms have been coloured with yellow paint or paper, the inhabitants of them have been sickly and delicate; as soon, however, as the colour was changed to blue, a marked difference in their state of health took place. The germination of seed is greatly retarded by actinism; hence, the malster puts his grain into the dark, to malt or semi-germinate. For the same reason, seed is buried in the ground. As soon, however, as the young plant makes its appearance, a supply of actinism is necessary, and, by a wonderful provision of nature, this influence is at its height when young plants are beginning to show their heads above the earth. White, red, brown, and green sea-plants owe their colour to the different amounts of actinism they receive: the green, being near the surface, receive most; while the white, being at great depths, receive nearly none. (*See* LIGHT and SPECTRUM.)

ACTINOCRINITES, *ak-tin-o-crin-i'-tees*, a genus of *Crinoidea*, comprehending a great many species. It is found in carboniferous and Silurian strata. (*See* CRINOIDEA.)

ACTINOLITE, *ak-tin'-o-lite*, a crystallized mineral, found in masses in primary stratified rocks, and, occasionally, in trap rocks. It is of a green colour, and is a variety of hornblende.

ACULEI, *a-ku'-le-i* (Lat., *aculeus*, a prickle), in Bot. (*See* PRICKLES.)

ACUMINA, *a-ku'-me-na* (Lat., *acumen*, a point), omens taken by the ancients from the points of spears or swords.

ACUMINATE, *a-ku'-me-nait* (Lat., *acumen*, the point of anything), in Bot., a term applied to the apex of a leaf when it is long and tapering. The leaf of the white willow has an acuminate apex.

ADAMANT, *ad'-a-mant* (Gr., *a*, not, *damao*, I break), a supposed impenetrable stone; a term applied to the diamond and other bodies of extreme hardness. (*See* DIAMOND.)

ADAMANTINE SPAR, *ad-am-an'-tine.* (*See* CORUNDUM.)

ADAMIA, *a-dai'-mi-a*, a genus of plants of the order *Hydrangeaceæ;* natives of Nepaul, and named after John Adam, a celebrated promoter of natural history in India.

ADANSONIA, *ad-an-so'-ne-a*, in Botany, a genus of plants, named after Michel Adanson, a celebrated French naturalist, and belonging to the tribe *Bombaceæ*, of the Silk-cotton order, or *Sterculiaceæ*. *Adansonia digitata*, the baobab-tree is the typical species. This is remarkable for its enormous size, and for its extraordinary longevity. One specimen has been found to have a trunk nearly 100 feet in circumference; and the age of this gigantic vegetable is probably many thousand years. The leaf of the baobab is digitate, branched into finger-like leaflets; hence its specific name. The fruit commonly known as monkey-bread, or Ethiopian sour-gourd, is a large oval capsule, containing a starchy pulp, having a slightly acid flavour, which forms a wholesome and agreeable article of food. Mixed with water, it makes an acid drink, which is highly esteemed as a specific in putrid and pestilential fevers, and is also employed by the Egyptian doctors in dysentery. The leaves have astringent properties; and, when dried and powdered, they form the condiment called *lalo*, which the Africans mix with their daily food as a preventive of excessive perspiration. The bark is said to be febrifugal, and its fibres are used by the African tribes living in the districts where the Baobab flourishes for the manufacture of cordage and various articles of dress. Adanson first described this remarkable plant.

ADAPIS, *a'-dap-is*, in Zool., the name of a genus of fossil pachydermatous (thick-skinned) mammals, first described by M. Cuvier, who deduced its existence and anatomical conformation from three fragments of the head, which had been discovered in the gypsum-quarries of Montmartre.

ADAPTATION, in Biology, the process by which an organism or species becomes modified to suit the conditions of its life. As employed by evolutionists, the term generally implies such modification as arise in an individual, when some change of function and structure is produced by a change of external conditions. *Indirect adaptations* are those which are directly generated in an organism, but only become apparent in its offspring. (*See* EVOLUTION.)

ADDA, *ad'-da*, the Arabic name for a small species of lizard found in Arabia, Egypt, and Nubia, wherever the smallest degree of moisture exists.

ADDAX, *ad'-dax*, a large white antelope, *Addax* (or *Oryx*), *nasomaculátus*, found in Northern and Central Africa.

ADDER, *ad'-der*, the common viper. The death or black adder (*Acanthopis tortor*) of Australia, and the puff adder (*Clothio arietans*) of South Africa, are both highly poisonous. In the Bible "adder" means poisonous serpents generally. (*See* VIPER.)

ADDER'S-TONGUE, in Bot., the familiar name for a tribe of ferns. (*See* OPHIOGLOSSEÆ.)

ADDISON'S DISEASE, so named from its discoverer, Dr. Addison; a super-renal melasma, a mysterious disease connected with the kidneys, for which no cure is known.

ADDUCTOR MUSCLES, *ad-duk'-tor* (Lat., *adduco*, I draw towards), in Anat., are those muscles which draw the parts to which they are attached together. They are opposed to the abductor muscles. (*See* ABDUCTOR MUSCLES.)

ADELPHOUS, *a-del'-phus* (Gr., *adelphos*, a brother), in Bot., a word used to denote the union of the filaments of the stamens in certain flowers. The number of bundles formed by the union of the filaments is indicated by a Greek numeral prefixed to the word. Thus, when all the filaments join together in a single bundle, as in the mallow, the stamens are *monadelphous*. When the filaments unite so as to form two bundles, the stamens are *diadelphous*. The formation of three bundles is expressed by the term *triadelphous;* and of any greater number, by *polyadelphous*.

ADENITIS, *a-den-i'-tes*, in Surgery, inflammation of the lymphatic glands, with which is ordinarily associated inflammation of the lymphatic vessels (*angeioleucitis*.) It generally originates in a puncture, cut, or other open wound being infected by some morbid matter, or the putrid secretion of a sore, or by some irritating or poisonous matter from without. In severe cases the symptoms are rigour, nausea, vomiting, thirst, sleeplessness, and the characteristics of fever. It is a good precaution to smear the hands with oil or grease before touching noxious fluids.

ADENOCELE, *a-dene'-o-se-le*, from a Greek word signifying a gland and a tumour, a mammary or glandular tumour on the breast of a woman. Excision is generally necessary.

ADHERENT, *ad-he'-rent*, in Bot., a term applied to a calyx or perianth, the tube of which adheres more or less to the ovary, as in the flowers of the iris, gooseberry, and myrtle.

ADHESION, *ad-he'-shun* (Lat., *adhærere*, to stick to), in Phy., a term applied to the property possessed by certain fluids and solids of becoming attached to each other when brought into contact. Adhesion is frequently confounded with cohesion, which is generally taken to mean the force which keeps the particles of the same body in close union. The examples and uses of adhesion are too familiar and numerous to need mention in detail. It will be sufficient to notice those cases where it is likely to be confounded with cohesion, atmospheric pressure, or chemical affinity. If metals are dipped into mercury, an adhesion of the particles of mercury, differing in force in different metals, takes place. This is evidently the result of chemical affinity, as those metals which most readily form amalgams exercise the greatest attraction for the mercury, gold being at the top of the scale, and iron and cobalt at the bottom. If two pieces of lead are scraped clean and pressed together, they adhere with considerable force. When two flat polished glass plates are pressed together they can scarcely be separated. Friction is the result of the adhesive force existing between bodies, and is generally greatest between those of similar constitution. In machinery, grease, oil, plumbago, or French chalk is used to lessen the grinding action of moving bodies, on account of the small amount of cohesion existing between their molecules. When parts of machinery rub against each other, they are always made of different metals, for the reason above mentioned. Iron, working in gun-metal, is generally found to produce the least amount of friction. (*See* COHESION, FRICTION.)

In Surgery, the process by which parts, naturally separate, or separated by artificial means, become united. It is caused by the effusion of a lymph, or sticky fluid, produced by inflammation; and hence, it is sometimes necessary to produce inflammation, by scraping or paring, in surfaces which it is desirable to unite. This tendency of inflamed surfaces to adhere when in contact is sometimes troublesome, as in inflammations of serous membranes.

ADIANTUM, *ai-di-an'-tum* (Gr., *adianton*), in Bot., the Maiden-hair genus of ferns, including some sixty species, mostly tropical. Two are found in temperate regions, namely, *Adiantum capillus Veneris*, the true maiden-hair; and *A. pedatum*, the Canadian maiden-hair. The former, which has obtained its name on account of the colour and extreme fineness of its stem and nerves, is found in Scotland and Wales, growing on damp rocks; and its elegant fronds make it a great favourite with collectors. Syrup of capillaire is properly prepared by adding sugar and orange-flower-water to an infusion of maiden-hair.

ADIPOCERE, *ad'-i-po-seer* (Lat., *adeps*, fat, *cera*, wax), a term applied by the French *savans* of the last century to a product of the decomposition of animal substances in moist earth or under water. It is principally margarate of ammonia, and is a fatty body, somewhat resembling spermaceti. A similar substance found in peat is known in Ireland as bog-butter.

ADIPOSE TISSUE, *ad'-i-pose* (Lat., *adeps*, fat), in Physiol., comprises an aggregation of minute cells filled with fat, which they appropriate from the blood. This tissue serves several important purposes in the animal body; filling up interstices, forming a pad or cushion for the support of the moveable parts, and assisting in the retention of heat.

ADJUTANT, a gigantic crane belonging to the *Ardeidæ* or Heron family, inhabiting the warmer parts of India. Its scientific name is *Leptoptilos argala* the extended wings measure about fourteen feet from tip to tip. It stands five feet high; the neck and head are almost bare; the beak very large, long, and of extraordinary strength. Beneath the beak hangs a downy pouch like a dewlap, which the bird has the power of inflating. The upper part of the adjutant is of an ash-grey colour, the under part white. Its voracity is wonderful: it can swallow a fowl, a rabbit, or a leg of mutton at a mouthful; and it is extremely useful in devouring all sorts of carrion. In Calcutta it is called the Scavenger, and any person wantonly killing one is fined. In their wild state, these birds live in companies. (*See* MARABOU).

ADMIRAL, in Conch., a beautiful shell of the Volute species, and comprising four kinds:—the Grand-admiral, the Vice-admiral the Orange-admiral, and the Extra-admiral. The first is of a fine white enamel, with bands of yellow finely turned about the head, and the clavicle excited. It is principally characterized by a denticulated line along the centre of the large yellow band: this distinguishes it from the Vice-admiral. The Orange-admiral has more yellow; and the bands of the Extra-admiral run into each other.

ADNATE, *ad'-nait* (Lat., *ad*, to, and *natus*, a growing), in Bot., a term applied to certain portions of a plant when they adhere to other portions: thus, when the stipules are united to the petiole, as in the leaf of the rose, they are called *adnate stipules:* when the anther is closely attached to the filament, as in the flower of the buttercup, it is said to be an *adnate anther.* The term *adherent* has the same signification.

ADONIS, *a-do'-nis*, in Bot., a genus of plants belonging to the Buttercup order, or *Ranunculaceæ.* The common adonis, *A. autumnalis*, or pheasant's-eye, is a favourite annual in English gardens. Its flower is of a bright scarlet, with a black spot or eye in the centre. The colour of the petals has been poetically ascribed to their being stained with the blood of Adonis.

ADOXA, *a-dox'-a* (Gr., *a*, without, and *doxa*, glory), in Bot., the Moschatel, a genus of plants belonging to the Ivy order, or *Araliceæ.* The typical species, *A. moschatellina*, is a curious inconspicuous little plant, having a tuft of pale green flowers.

ADRAGANT. (*See* TRAGACANTH.)

ADULARIA, *ad'-u-lai'-ri-a*, in Min., a kind of felspar, resembling clear transparent glass. It is found in volcanic districts, and is named from Mount Adula, in Switzerland.

ADVANCEMENT OF SCIENCE. (*See* BRITISH ASSOCIATION.)

ADVENTITIOUS ROOTS, in Bot., roots which are not produced by the direct elongation of the radicle of the embryo. They generally spring from the true roots, from suckers, runners, bulbs, and other subterranean modifications of the stem.

ÆCIDIUM, *e-sid'-i-um*, in Bot., a genus of microscopic parasitic fungi. There are numerous species, some of which infest useful garden plants, such as the mint and the gooseberry.

ÆGAGRUS, *e-gai'-grus*, the Paseng of the Persians, a wild species of Ibex. (*See* GOAT.)

ÆGICERACEÆ, *e-ji-se-rai'-se-e*, in Bot., the Ægiceras order of dicotyledonous plants. This includes but one genus, of which there are five species. These plants grow near the sea in tropical regions, throwing out adventitious roots into the mud, like mangroves.

ÆGILOPS, *e'-ji-lops*, in Bot., a genus of *Glumaceæ*, the Grass order. The species *Ægilops ovata* was formerly supposed to be the origin of all the varieties of cultivated wheat; and it is undoubtedly true that a kind of wheat may be produced by the union of this plant with a species of *Triticum.* The hybrid, after about twelve years' cultivation, becomes a wheat-bearing grass.

ÆGLE, *e'-gle*, in Bot., a genus of *Aurantiaceæ*, the Orange order. The bark of the *Ægle marmelos*, or Indian bael, has been introduced into this country as a remedy for diarrhœa. The rind of its ripe fruit yields an agreeable perfume.

ÆQUILATERUS. (*See* EQUILATERAL.)

AERIAL BULBS, *ai-eer'-i-al*, in Bot., small conical or rounded bodies of the nature of bulbs, which grow in the axils of the leaves of certain plants, as the bulbiferous lily and in the pilewort.

AERIAL IMAGES. (*See* MIRAGE and FATA MORGANA.)

AERIAL LEAVES, in Bot., leaves which grow in the air, as distinguished from those which flourish under water.

AERIAL POISONS. (*See* MIASMA.)

AERIAL ROOTS, those adventitious roots which are produced in the air. The little threads which spring from the stem of the ivy, the descending columns of the banyan-tree, and the green fibres thrown out by the curious air-plants, are examples.

AERO-DYNAMICS, *ai'-e-ro-di-nam'-iks* (Gr., *aer*, air, and *dynamis*, power), is the science which treats of properties of aëriform fluids in a state of motion. Currents are created in innumerable ways; amongst others, by the local change of temperature; by the permanent difference of temperature between the polar and equatorial regions; and by the rotation of the earth on its axis. It is also effected by the evaporation of the sea and rivers. Aqueous vapour being much lighter than the air, causes motion in its passage to the cloud region. The laws which govern projectiles are properly part of this science. (*See* PROJECTILES; *see also* RIFLE, GUNNERY, ANEMOMETER, ACOUSTICS.)

AEROGRAPHY, *ai-e-rog'-ra-fe*, the description of the nature, properties, and phenomena of the atmosphere. (*See* ATMOSPHERE.)

AEROLITE, *ai'-e-ro-lite* (Gr., *aer*, air, *lithos*, a stone), a stone fallen from the atmosphere, meteoric stones, fireballs and shooting-stars are now known to be varieties of aërolites. The source of these bodies has greatly puzzled philosophers; and until the commencement of the present century they were regarded as instances of ancient superstition. Since the report of M. Biot, however, in 1803, concerning an extraordinary shower of stones which fell near L'Aigle in Normandy, the existence of meteoric stones has never been questioned, and the researches of La Place, Chladni, and others have now placed the fact beyond dispute. They are mostly of uniform composition, consisting principally of silica, magnesia, and iron, with small quantities of nickel, sulphur, and chromium. Some of them are very large, weighing many pounds. The largest known is one which fell in Brazil, estimated to weigh 14,000 lbs. Sometimes they fall singly, and occasionally in showers, but they all present the same characteristic when they reach the earth of having a thin black covering like varnish, which is supposed to indicate the rapid action of heat. Shooting stars are now known to be meteoric stones which are consumed by the heat generated in their passage to the earth. The most recent researches seem to point to the fact that every form of matter exists in the inter-planetary spaces, and that there are detached masses of minerals and also rings or belts of smaller stones all circling round the sun. The former give rise to the *sporadic* or single meteors or aërolites, and the latter to the showers of stones or shooting stars. Thus astronomers are able to predict with some degree of certainty as to the date of the more brilliant swarms. November, 1799, 1833, and 1866, have been the dates of the most brilliant manifestations, and as each appeared after a lapse of 34 years it is predicted that November, 1900 will be the occasion of the next brilliant display.

AEROPHYTES, *ai'-e-ro-fites* (Gr., *phyton*, a plant), in Bot., plants having only aërial roots. (*See* AIR-PLANTS.)

AEROSTATICS, *a-e'-ro-sta'-tics*, the science of the equilibrium and pressure of air and other gases and the method of measuring it; also the phenomena of the compression of gases. The mean pressure of the atmosphere, nearly 15 lbs. on every square inch is generally taken as the unit of measure of expansive or elastic force. A rise of temperature of 1° Fahr. causes any gas to expand about 1-480th of its own bulk.

ÆSCHYNOMENE, *ees'-ki-nom'-i-ne*, in Bot., a genus of leguminous plants, mostly natives of India. The stems of the *Æschynomene paludosa* furnish the shola, or Indian rice-paper, and, on account of their extreme lightness, are used for making floats and buoys. *Æ. cannabina* yields the fibre known as Duchai hemp.

ÆSCULUS, *ees'-ku-lus*. (*See* CHESTNUT.)

ÆSTIVATION, *ees-ti-vai'-shun*, in Bot., a term literally meaning the summer state, is applied to the general arrangement of the different parts of a flower, but previous to its opening into full bloom. When the parts are placed in a circle, and in nearly the same plane, the æstivation is said to be *circular*, and when they are placed at slightly different levels, so as to overlap each other, it is said to be *spiral*. If the edges are turned in, the æstivation is spoken of as *induplicate*, and if they are turned out, it is *reduplicate*. In poppies, the petals are crumpled together. The term *præfloration* is used by some botanists instead of æstivation.

ÆSTUARY. (*See* ESTUARY.)

ÆTHER. (*See* ETHER.)

ÆTHUSA, *e-thu'-sa*, in Bot., a genus of umbelliferous plants. *Æthusa Cynapium*, fool's parsley, is a common indigenous plant, highly poisonous, which has been frequently mistaken for parsley.

ÆTOBATES, *e-to-bai'-tees*, a genus of fossil fishes allied to the Rays, the species of which are found at Sheppey, in the London clay.

AFFINITY, OR CHEMICAL ATTRACTION, is the force which causes the particles of dissimilar kinds of matter to unite together, so as to form new matter. It differs from *cohesion*, (which is a modification of molecular attraction, and produces merely a mechanical mixture) by bringing about the union of heterogeneous particles, and causing them to lose their individual properties. The result is a new compound differing entirely from the substances which combined to produce it. For example, the inflammable metal *sodium* unites with the suffocating gas *chlorine*, and the compound thus produced is *chloride of sodium*, or common salt, a substance which does not bear the slightest resemblance to either of its components. Chemical combinations do not take place indifferently, but in accordance with certain strict rules or laws. One substance will unite with another in preference to a third, or in some cases in preference to any other. This preference is denoted by the term *elective affinity*. By means of this discriminating action of affinity, some combinations may be *decomposed*. Affinity is generally much stronger between bodies which are very unlike each other, than between bodies which are closely allied. Thus, potassium and sodium tend strongly to unite with chlorine and iodine, but the bodies of each pair do not attract one another with sufficient force to enter into combination. The discoveries of Faraday and others have established the fact, that whenever two substances unite to form a compound, they are in opposite electrical conditions; one being electro-negative, and the other electro-positive. This and other facts go to prove that chemical affinity is a particular modification of electrical attraction. (*See* ELECTROLYSIS.) The word "affinity" appears to have been employed for the first time by Barkhausen, a German chemist, in his "Elements of Chemistry," published at Leyden in 1703. (*See* CHEMISTRY.)

AGALMATOLITE, *a-gal'-ma-to-lite* (Gr., *agalma*, statue, *lithos*, stone), a white, translucid, waxy-looking mineral, commonly known as *figure-stone*, brought from China, carved into little grotesque figures. It is usually delicately tinted with pink, grey, yellow, or green, and can be easily cut and modelled with a sharp instrument. It consists solely of silica and alumina, with a little carbonate of lime and potash.

AGAMI, OR GOLD-BREASTED TRUMPETER, *a-ga'-me*, *Psophia crepitans*. A bird about the size of a pheasant or large fowl, with long neck and legs, but a short tail. It is found in numerous flocks in South America; can run swiftly, and, when pursued, trusts less to its wings than to its legs. It is easily domesticated.

AGAMA, OR AGAMIDÆ, *a-ga'-ma*, a family of Saurian reptiles. They have short, broad, flat heads, and thick depressed bodies, enveloped in a loose skin, which is capable of being distended with air at the will of the animal. Different species of Agamidæ are found in Asia, Africa, Australia, and America. Some species can change the colours of their skin, which causes the natives of South America to call them chameleons. They are of diminutive size, and generally lurk among rocks, heaps of stones, and mouldering ruins. Some of the more active kinds, however, climb trees, play among the branches, and feed upon insects and other small animals. One tribe, found in India, is said to be herbivorous. The *Frilled Agama*, a native of Australia, is a very extraordinary looking animal. Around its neck, and covering its shoulders, it carries a frill, which, on the approach of danger, is elevated.

AGAMÆ, *ag'-a-me* (from a Greek word meaning "without sex"), in Botany, a term applied to cryptogamic and other plants, which have the organs of reproduction, but are flowerless and without seed-lobes.

AGAMOGENESIS, *ag'-a-mo-jen'-e-sis*, a name given by M. Quatrefages, the French naturalist, to reproduction without influence of sex, which has been observed both in animal and vegetable nature. The aphides, or "blight-insects," and the daphniæ, or "water-fleas," and several kinds of butterflies, possess the power of producing living offspring when perfectly developed; although, in the case of aphides, the ordinary mode of reproduction by eggs is also common. The pistil-bearing, or female plant of the cælobygne, an Australian plant, kept in the country with no male, or stamen-bearing plant near it, annually bears fruit and fertile seed.

AGAMOUS, *ag'-a-mous* (Gr.), is a term used by some writers instead of cryptogamic. It is principally confined to confervæ, lichens, fungi, and similar groups. They are said to have no functions analogous to those of sex.

AGAPANTHUS, *ag-a-pan'-thus* (Gr., *agape*, love, *anthos*, flower), in Botany, plants belonging to a genus of the natural order *Liliaceæ*. The typical species is *Agapanthus umbellatus*, the African blue lily, a native of the Cape of Good Hope, whence it was brought to Holland, and, in 1692, it was cultivated at Hampton Court. It is now a favourite garden plant. It grows nearly a yard high, and, in July, bears a handsome bunch of blue flowers, which have no scent.

AGAR-AGAR, *ag'-ar*, a name sometimes given to the alga commonly known as Ceylon moss, used for making jellies. (*See* GRACILARIA.)

AGARICUS, *a-gar'-i-kus* (Gr., *agarikon*, a fungus), the mushroom, a genus of fungi, characterised by the pileus, or cap, being distinct from the stalk, and having, on the under side, numerous flakes or gills radiating from the centre. The genus comprehends an immense number of species, many of which are edible. (*See* MUSHROOM.)

AGATE, *ag'-at* (Gr., *achates*), a semi-pellucid, variegated, and uncrystallized variety of quartz, named after Achates, a river in Sicily, whence the Greeks are said to have first procured it. Chemically, it consists almost entirely of silica, coloured by metallic oxides. The colours of agate are generally arranged in parallel or concentric bands, but sometimes form spots, clouds, and moss-like stains. These colours can be artificially heightened by boiling the stone in oil, and afterwards in sulphuric acid, and by other ingenious processes. Agates occur in nature as rounded pebbles, and are brought into this country from Oberstein, in Saxony, from Arabia, and India; some varieties, however, are found in Perthshire and other parts of Scotland. The Scotch pebble, or fortification agate, so called from its zig-zag pattern, is one of these varieties. Agates take a high polish, and their beautiful colours adapt them for many ornamental purposes. They are cut into brooches, seals, bracelets, and similar objects, and are largely employed for mosaic work. Veined calcedony, or agate, is, when properly prepared, used for the production of cameos and intaglios in imitation of ancient gems sculptured on onyx. In the useful arts, agates are employed as burnishers, and, when sufficiently large, they are made into mortars for chemical purposes. The moss agate, or Mocha-stone, is curiously marked with figures resembling growing tufts of moss. These markings were, until quite recently, supposed to be produced by vegetable structures imbedded in the stone; but Professor Göppert has proved that they are merely deposits of oxide of iron. Some of the remarkable figures resembling men or animals are usually artificially produced.

AGATHOPHYLLUM, *ag'-a-tho-fil-lum*, a genus of plants in the natural order *Lauraceæ*. The species *A. aromaticum* yields the Ravensara nut, or clove nutmeg of Madagascar.

AGAVE, *a-gaiv'* (Gr., *agauos*, admirable), a genus of monocotyledonous plants of the Amaryllis order, or *Amaryllidaceæ*. The typical species is *Agave Americana*, the American aloe or maguey. This agave was brought to Europe in 1561, and has been naturalized in Southern Europe and Northern Africa. The plant is of slow growth; but when fully developed, its leaves, which spring directly from the ground, attain a height of from five to eight feet. From the midst of the great cluster of leaves a flower-stem arises, and from this numerous flower-bearing branches spring, so that the whole plant has somewhat the appearance of a candelabrum. It was formerly erroneously supposed that the agave lived a hundred years before flowering; hence, it was frequently called the hundred years plant. It really flowers only once in about ten years, and the planter has to wait patiently for the flowering season to obtain a supply of pulque, as this liquor is formed from the juice contained in the young flower-stalk. As soon as this organ makes its appearance, the planter makes a deep cut in it, and scoops out the whole heart or middle part, leaving nothing but the outside rind. A natural basin, about two feet in depth, is thus formed, and into this basin, the sap which was intended to feed the shoot flows so rapidly, that it is necessary to remove it twice, and sometimes three times a day. To make this more easy, the leaves on one side of the basin are cut away. This sap before it is fermented, has a very sweet taste, and is called *aguamiel*, or honey-water. It ferments spontaneously, and forms the pulque, which is a refreshing, slightly-intoxicating drink, with a pleasant acid taste, but a very disagreeable odour. From pulque an ardent spirit is distilled, which is known by the name of *mexical*, or, less commonly, *aguardiente de maguey*. From the leaves of this and other species of the agave genus, the useful fibre called aloe-fibre, *pita*, or *pité* hemp, is obtained.

AGE, *aij*. During the progress of life from infancy to manhood, and from manhood to old age, the body undergoes certain marked changes, which distinguish the different periods or stages of life. The first age commences at birth, and extends to the end of the second year, by which time the first dentition is generally completed; the second extends to the end of the seventh or eight year, when the second dentition is commonly over; the third extends to the age of puberty, which varies in different countries, but with us is from twelve to fourteen in the female, and from fourteen to sixteen in the male; the fourth extends to about the twentieth year in the female, and the twenty-fourth in the male; the fifth period extends in the female to about the forty-fifth or fiftieth year, when the power of procreation usually ceases, and in the male to about the fiftieth year; the sixth period extends to the sixty-third year, when the seventh and last period of life commences. These divisions are of course not very precise in the latter stages; but mark with sufficient accuracy the successive periods of life. Shakspeare's description of the seven ages, in *As You Like It*, is known to everybody.

Of Animals.—It has been stated that the duration of an animal's life is generally seven or eight times longer than the period it takes to arrive at its full growth, a rule that applies moderately well to domestic animals, such as dogs, horses, sheep, oxen, and even elephants and camels, but is not applicable to man, or to the majority of quadrupeds, fishes, birds, or reptiles. The age of the horse may be calculated by an examination of the incisive teeth or nippers; but at ten years old these marks are lost, and no accurate calculation can be arrived at. Deer shed their horns every year, and, in the males of some species, each year adds a branch to the horns, until a certain size is attained. In sheep, oxen, antelopes, and goats, a ring is annually added to the base of the horn up to a certain age. There are no certain indications by which the duration of life of birds, fishes, and reptiles can be ascertained. The Indians assert that the elephant lives 300 years. Dogs live from 12 to 14 years, sheep 8 or 9, oxen about 20, horses, if well treated, from 25 to 30, camels from 40 to 50. Eagles have lived more than a century, and many instances are recorded of ravens having exceeded that period. Swans, also, have been known to live 100 years, parrots 60 and 80; pheasants and domestic poultry seldom reach more than 12 or 15 years. Among fish, the carp has been known to live 200 years. River trout have been confined in a well for 30 and 50 years. A pike has been known to exist in a pond 90 years. A story is related of one caught in a lake near Hailerun, in Suabia, which had attained the age of 267 years. Of reptiles, the tortoise is said to be the longest lived; but this may be doubtful, as nothing is known of the duration of life of the various tribes of serpents. Of the ages of insects, but little is known. The life of the caterpillar or grub, in its first period, extends to several months; but after the attainment of their perfect form, they live but a few days or weeks. As a general law of nature, early maturity indicates shortness of life.

Age of Trees.—This has been computed in a twofold manner—first by comparing them with other old trees whose rate of growth had been ascertained, and secondly by removing a portion of the trunk from the circumference to the centre, and counting the number of concentric rings, each of which, in exogenous trees, marks a year's growth. The following is a list of the ages to which certain trees have been known to attain:—Palm, 200—300 years; Elm, 355; Cypress, 388; Ivy, 448; Maple, 516; Larch, 263—576; Chestnut, 360—626; Oranges, Lemons, &c., 400, 509, 640; Plane, 720; Cedar, 200—800; Walnut, 900; Lime, 364, 530, 800, 825, 1,076; Spruce, 1,200; Oak, 600, 800, 860, 1,000, 1,600; Olive, 700, 1,000, 2,000; Yew, 1,214, 1,466, 2,588, 2,880; Baobab, 4,000; Dragon-tree, 6,000.

Age of the Moon, a term signifying the number of days elapsed since the last new moon.

AGGREGATE FRUITS, *ag'-gre-gait*, fruits formed by the combination of several flowers, as the pineapple and the mulberry. The term *anthocarpous* is more generally used. Some botanists apply the term aggregate to a compound fruit, consisting of numerous achænia, borne by a single flower; as the fruit of the ranunculus or the raspberry.

AGGREGATION, STATES OF. The three states in which matter occurs, solid, liquid, and gaseous. In the solid state, the molecules adhere so firmly that their relative positions cannot be changed without the application of force; in the liquid state, they more freely and readily act on each other; in the gaseous state, they have a tendency to separate and diffuse through a vacant space.

AGLAIA, *ag-lai'-a*, one of the group of small planets revolving between Jupiter and Mars. (*See* ASTEROIDS.)

AGLAIA, *ag-lai'-a*, a genus of dicotyledonous plants, order *Meliaceæ*. The flowers of *Aglaia odorata* are used for perfuming certain varieties of tea.

AGONIC LINES, *ag-on'-ic* (Gr., *gonia*, an angle), the imaginary lines on the earth's surface where the magnetic needle indicates a declination or deviation from the terrestrial meridian—that is, points to the true north and south. (*See* MAGNETISM, TERRESTRIAL.)

AGOUTI, *a-goo'-te*, the *Chloromys* of Cuvier, the *Dasyprocta* of Illiger, a genus of animals belonging to the class *Mammalia*, order, *Rodentia*, and family, *Hystricidæ*. They are about the size of a hare, have toes armed with long and very strong claws, and completely separate from each other; hind legs very much longer than the fore; head large, forehead and face convex; eyes full and black; ears short, round, and almost entirely denuded of hair; hair for the most part coarse and bristly, but in some species nearly as fine as the fur of the rabbit; twenty teeth. At the first settling of the West India islands they were very numerous, and were an article of consumption by the Indians; but the planters, finding them too destructive to the sugar-canes, have destroyed them in great numbers. Whilst eating, these animals sit upon their hind quarters, and hold their food between their fore paws. They are exceedingly voracious, live under decayed trees and fallen timber, are very prolific, and produce young more than once a year. Their flesh is good eating. There are seven perfectly ascertained species—viz., the common agouti (*Dasyprocta Aguti*), known also by the name of the long-nosed, or yellow-rumped cavy; the black or crested agouti (*Dasyprocta cristata*), sometimes termed the black-crested agouti; the acouchy, or olive agouti (*Dasyprocta Acuchi*); the white-toothed agouti (*Dasyprocta croconata*; the *Dasyprocta prymnolopha;* the sooty agouti (*Dasyprocta fuliginosa*); Azara's agouti. They are found in the hotter parts of South America, the West India islands, and Guiana.

AGRIMONIA, *ag-ri-mo'-ni-a* (Lat.), the Agrimony, a genus of dicotyledonous plants, belonging to the Rose order, or *Rosaceæ*. The species *A. Eupatoria* is one of our common roadside plants, and is found in flower about June. The leaves are large and deeply cut at the edge, and divided even down to the main stalk; the flowers are yellow, arranged on a long simple spike, with a little leaf at the base of each, and the fruit is beset with bristles. This plant has been used in medicine as a vermifuge and an astringent.

AGROSTEMMA, *ag'-ros-tem'-ma*(Gr., *agros*, a field, *stemma*, a crown), a genus of dicotyledonous plants of the Pink order, or *Caryophyllaceæ*. The species *A. githago* is the common corn-cockle, a well-known ornamental plant in our corn fields.

AGROSTIS, *ag-ros'-tis*, a genus of Grasses, including numerous species, all furnishing excellent forage.

AGUE, OR INTERMITTENT FEVER, *ai'-gu* (Fr., *aigue*, sharp), a disease generally occasioned by exhalations arising from marshy grounds, stagnant water, or decaying vegetable substance. It is characterized by a series of separate attacks, occurring at regular intervals of one or more days, according to which it is termed quotidian, tertian, or quartan. Each attack is divided into three stages—cold, hot, and sweaty, which follow each other in regular succession. During the cold stage, warm baths, diaphoretic drinks, and such like means, are to be adopted; in the hot stage, saline draughts and diaphoretics should be administered; and, in the last stage, the patient is to be kept cool, and, if very weak, may receive a little wine or brandy-and-water. The general treatment in ague is to strengthen the system by means of tonics, such as quinine or Peruvian bark. A temperature above 60° Fahr., combined with moisture, appears to be necessary to produce this disease.

AHRIAN, *air'-i-an*, a term applied by geologists to the middle group of the series of Devonian rocks belonging to Belgium and the Rhine. This group includes bluish-grey grits, sandstones, and shales.

AIGLET, *ai'-glet*, a young eagle. (*See* EAGLE.)

AIGRETTE, OR EGRETTE, *ai'-gret*, a term formerly applied to a little feathery crown or tuft attached to the seed-case or fruit of the dandelion, the scabious, and many other plants, and by means of which the seed is transported through the air to a distance. This peculiar appendage is now called a *pappus*. (*See* PAPPUS.) The term is also applied to the feathery tuft on the head of several birds, as the heron; and to long upright feathers when worn in a lady's headdress, or even to a bunch of flowers arranged in plume fashion and fastened with diamonds. The Shah of Persia wears in his headdress a magnificent arrangement of precious stones in the shape of a fan, described as an aigrette.

AILANTO, *ai-lan'-to*, a tall and beautiful tree, the *A. glandulosa*, of the natural order Xanthoxyton. The leaves are large and pinnate, with an odd leaflet. The tree is a native of China, but has been introduced into Europe, and is used as a shade for public walks. It grows well in chalky soil, and the timber is fine grained.

AIR, *aar* (Gr., *aer*, air).—This term is generally taken to mean the atmosphere with which our globe is surrounded; but in the chemical works of the last century it is often applied to bodies known at the present day as gases. (*See* ATMOSPHERE.)

In Music, a term which, when applied to vocal music, signifies a composition for a single voice. It is synonymous with melody.

AIR-BLADDER, OR SWIMMING-BLADDER, an organ which, in fishes, generally adapts the specific gravity of their bodies to the weight of the water in which they are at different depths. This purpose is served by the increase or diminution of its volume, according to the degree of pressure exerted upon it by the water. The air-bladder is placed in the abdomen, under the spine, and it varies considerably in size and shape in different kinds of fishes. The finest kind of isinglass is made from it. (*See* ISINGLASS.)

AIR-CELLS OR SACS, are cells, or cavities, in the lungs of animals of the class Mammalia, into which the air is conveyed by minute ramifications of the windpipe. In birds, the air-cells are distributed along the inside of the whole cavity of the chest and abdomen, and in birds of rapid flight are often prolonged into the bones. They are connected with the respiratory system. In insects, air-tubes connected with the cells ramify throughout the whole body. In some of the lower organizations, air-cells may be said to form the whole respiratory apparatus.

In Botany, cavities containing air in the stems or leaves of plants. They are large and numerous in aquatic plants, for the purpose of buoying them up in the water.

AIR-PLANTS, are those members of the vegetable kingdom which derive nourishment entirely from the air by means of slender aërial roots. (*See* EPIPHYTES.)

AJUGA, *a-joo'-ga*, the Bugle, a genus of plants belonging to the Labiate order. *A. reptans* is a common plant in moist pastures. The stem is creeping, but the flowering part erect. This part has many leaves or bracts of a purplish hue, proceeding from each whorl of labiate flowers: the latter are generally blue, sometimes white or flesh-coloured.

AKEE FRUIT, *a-ke'*, the produce of a species of soapwort growing in the West Indies. (*See* CUPANIA.)

AKI, *ai'-ki*, the native appellation for the *Lignum vitæ* of New Zealand. This and other species of the genus *Metrosideros* (and the *Myrtaceæ*, or Myrtle order) afford valuable timber, used by civilized races in many of the peaceful arts, and by the South-Sea Islanders to form their terrible clubs.

ALABAMA BEDS, *al-a-ba'-ma*, a group of rocks in North America, placed by Sir Charles Lyell among the productions of the middle Eocene period.

ALABASTER, *al-a-bas'-ter*, a white substance used for ornamental purposes. Its name is derived from Alabastron, in Upper Egypt, whence the ancients obtained a supply of the stone, and where it was manufactured into vases and other small vessels. The ancients made use of these vessels to hold a certain kind of perfume, with which, according to Horace, it was the custom to anoint the heads of the guests at a feast. Mary, the sister of Lazarus, poured a "very precious ointment" from an alabaster box upon the head of our Saviour whilst seated at supper. In the British Museum there are several of these ancient alabaster vessels. There are two varieties of alabaster; one a carbonate of lime (known as Oriental alabaster, and deposited from water in the form of stalagmite, &c.), and the other gypsum, or sulphate of lime. The latter is that which is generally known as alabaster. It is a soft stone, may be scratched with the nail, and is beautifully white and semi-transparent. Being easy to work, large quantities of vases, lamps, and toys are made from it. The finest sort of alabaster is obtained from Volterra, in Tuscany, and it is also found in Derbyshire and Staffordshire.

ALANGIACEÆ, *al'-an-ge-ai'-se-e*, the *Alangium* order of monocotyledonous plants, including four genera and eight species, which are trees or shrubs, natives of various parts of the East Indies, and North America. The fruits of most of these plants are edible; that of the *Nyssa capitata* is used as a substitute for lime-fruit, and is sometimes called the *Ogechee* lime.

ALARIA, *a-lair'-i-a*, a genus of fucoideous sea-weeds. One British species is known, *A. esculenta*, a common sea-weed, having a large flat and narrow leaf-like frond, with a thick midrib, or prolongation of the stalk by which it is attached to the rocks. It grows from four to twelve feet long, and is sometimes employed for food. Its common names are Bladderlocks, Hen-ware, and Honey-ware.

ALAUDA. (*See* LARK.)

ALBATA. (*See* NICKEL.)

ALBATROSS, *al'-ba-tross* (*Diomedia*), a gen. of web-footed birds, of which there are three species—the common albatross, *D. exulans;* the albatross, *D. fuliginosa* (chiefly found in the Antarctic circle, and known to sailors as the Quaker Bird, on account of the prevailing brown colour of its plumage); and the yellow-and-black-beaked albatross, *D. chlororynchos.* A long hard beak, curved at the extremity, the upper mandible composed of several articulated pieces, the lower mandible smooth and short; the nostrils lateral, and placed like small rolls in the furrow of the mandible; feet short, with the three toes long and completely webbed; wings long and narrow. The common albatross, which is often met with in the seas of Southern Africa, is the largest sea-bird known, its weight varying from 12 to 28 lbs. A specimen in the Leverian Museum measured 13 feet between the extremity of the extended wings. One remarkably large bird, shot off the Cape of Good Hope, measured from wing to wing 17½ feet. The top of the head is a ruddy grey, the rest of the plumage, with the exception of several transverse black bands on the back, and a few of the wing-feathers, is white; the bill is of a pale yellow, and the feet and membrane of a deep flesh-colour. Towards the end of June, these birds hover in immense flocks about Behring's Straits and Kamtschatka, attracted thither by the shoals of fish, whose migrations the albatross perseveringly follows. So great is its voracity, that it will swallow a salmon of 5 lbs. weight; it does not, however, limit its diet to fish, but will prey on any sea animal. Its strength of wing is very great, and it will accompany a ship for many days without appearing to require rest. Sailors regard its presence as a good omen, and Coleridge's ballad, "The Ancient Mariner," relates the doom of the man who wilfully shot an albatross.

ALBINO, *al'-bee-no* (from Lat., *albus*, white), a person of a preternatural whiteness of the skin and hair, and peculiar redness of the pupil of the eye, which, in some cases, is so weak as not to be able to bear the light of day. The Portuguese first applied the term to the white negroes whom they found on the coast of Africa, but it is now used to designate persons who exhibit similar characteristics, of whatever race. Albinism, or Leucopathia, is the name applied by scientific writers to the peculiarity. Albinism does not imply a diseased condition of body, or a want of physical or mental vigour; and it is to some extent hereditary. The appearance arises from the absence of the colouring matter of the epidermis, or outer skin. It is common in many species of animals.

ALBUMEN, *al-bu'-men* (Lat., *albus*, white), in Chem., a whitish viscous matter slightly salt to the taste, and an important element in vegetable and animal organic substances. It is distinguished by its peculiar property of becoming coagulated or insoluble at a high temperature. White of egg and serum of blood consist almost entirely of albumen. The hair and nails contain large quantities of it in its coagulated state. Pure albumen is insoluble in water. White of egg and serum contain a certain amount of free alkali, in which it is dissolved; hence its precipitation when acids are added. It is also precipitated when salts of mercury, copper, silver, lead, &c., are added to its solution, forming with them definite insoluble compounds. This property renders it valuable as an antidote to metallic poisons. Tannin, gallic acid, and extractive matter behave with it in a similar manner; for which reason it is used much in the arts as a clarifying agent. It is very important as an element of diet. (*See* FOOD.) It is greatly used in photography, for giving depth and intensity to photographic prints. Its chemistry is very complex, and requires investigation. Its average composition is given below, the presence of sulphur being rendered familiar to all by the effects of cooked eggs upon silver spoons.

Carbon, ...	53·5
Hydrogen, ...	7·0
Nitrogen, ...	15·5
Oxygen, ...	22·0
Phosphorus, ...	0·4
Sulphur, ...	1·6

In Botany, the cellular structure which surrounds the embryo of a seed. It is not present in every case; for sometimes the embryo alone forms the nucleus of the seed, as in the pea, the bean, and the wallflower. When it is present, the amount of space it occupies is in inverse proportion to that occupied by the embryo; in other words, the larger the embryo the smaller the albumen. A seed entirely devoid of this structure is said to be *exalbuminous*, and one which includes it, *albuminous*. The cells of the albumen contain nutriment for the germinating embryo in the form of starch, of oil, or of cellulose. Sometimes the cells are thickened by secondary deposits, and the whole structure becomes horny; thus, vegetable ivory is nothing more than the albumen of the seed of a species of palm. The stone of the date, and the nut of the areca palm, are further examples of hardened albumen. In the seed of the coffee-plant, the albumen is the horny portion which is so familiar to us as the "coffee-berry." Some botanists use the term *perisperm* for this structure, as the word *albumen* has a totally different signification in chemistry.

ALBUMINURIA, *al-bu-mi-nu'-ri-a*, or BRIGHT'S DISEASE, a disease characterized by the presence of albumen in the urine, a more or less general dropsy both of the cellular tissue and the internal cavities, and an organic change in the substance of the kidneys. The disease was first described by Dr. Bright.

ALBURNUM, *al-bur'-num* (Lat., sap-wood), the white and comparatively soft part of an exogenous stem, between the inner bark and the *duramen*, or heart-wood. The difference between these two kinds of wood is often very striking. Thus, in the ebony-tree the duramen is black and the alburnum pale. All the vital functions are performed by the sap-wood, as is proved by the vigorous growth of many a hollow tree.

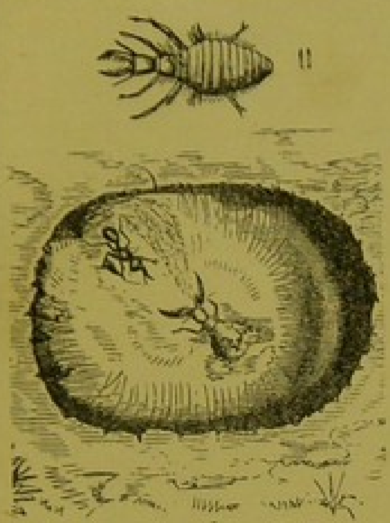
ALCA AND ALCADÆ, *al'-ka, al'-ka-dæ.* (*See* AUK.)

ALCEDO. (*See* KINGFISHER.)

ALCES, *al'-sees*, the Elk. (*See* DEER.)

ALCHEMILLA, *al-ke-mil'-la*, in Bot., the Lady's mantle, a genus of plants in the natural order *Rosaceæ*, sub-order *Sanguisorbeæ.* Three British species are known—*A. alpina, A. vulgaris*, and *A. arvensis*—the mountain, common, and field lady's-mantles. They have small green flowers arranged in bunches. The latter species is thought to be diuretic.

ALCOHOL, *al'-ko-hol* (Arab., *al*, the, *koohl*,

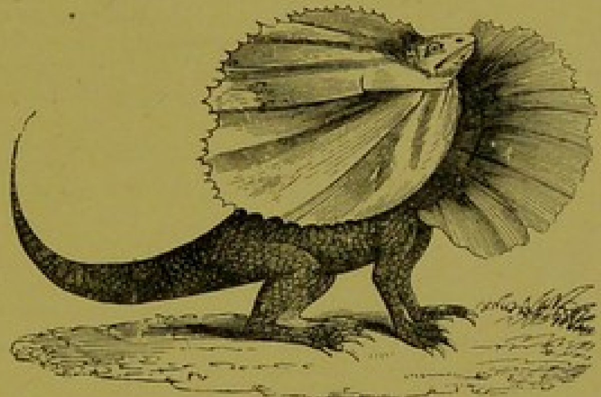


ANT-LION.

ANTELOPE.

ARUM.

ARGALI.

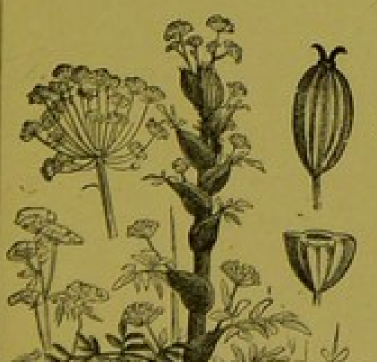


AGAMA.

AGOUTI.

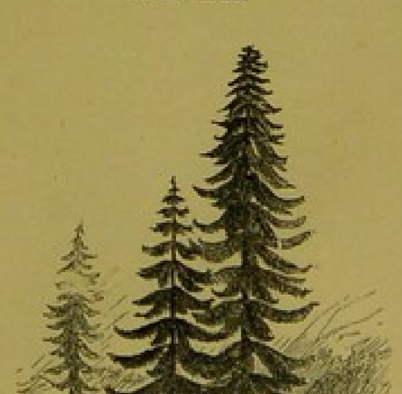
ALOE TREES.

AMMONITES.



ASAFŒTIDA PLANT.

ASP.



ARAUCARIA.

any volatile substance), the characteristic ingredient of fermented liquors is produced by the fermentation of sugar or other saccharine matter, the produce of the vegetable world. Pure alcohol cannot be obtained by distillation alone, the strongest product containing about 10 per cent. of water; but, if chloride of calcium, quicklime, or carbonate of potash be added, the water is absorbed, and pure alcohol can be obtained. Pure alcohol is colourless and limpid, pungent to the taste and smell. Its specific gravity at 60° is ·7938. It boils at 173°, and has been rendered gelatinous by cold, but has never been frozen. It is very inflammable, and burns without smoke. It mixes with water in all proportions, and has a great attraction for it. Its solvent powers are great, especially with respect to resins and resinous gums. The strength of alcohol is in exact proportion to its density, which is estimated by means of a hydrometer. Excise proof spirit has a specific gravity of ·9186, and contains 49¼ per cent. of absolute alcohol. Spirits of wine, the strongest form of alcohol which can be produced by distillation alone, is from 54 to 58 over proof; and, when mixed with 10 per cent. of wood spirits, is known in commerce as methylated spirit. The chemical formula of alcohol is C_2H_6O; and it is thus composed—

Carbon	52·67 per cent.
Hydrogen	12·90 „
Oxygen	34·43 „
	100·00

Alcohol, when acted on by other chemical substances, produces a great variety of new compounds. One, the well-known anæsthetic chloral, is produced by the treatment of alcohol with chlorine. Another, bromal, is obtained by the employment of bromine. Chloroform is produced by the treatment of alcohol with a solution of chloride of lime. As alcohol does not freeze, it is employed to fill thermometers for registering low temperatures, in place of mercury; it is very valuable as a solvent, and is used in the manufacture of varnishes and as fuel for spirit-lamps. In medicine it is applied both internally and externally; in the former case as a stimulant and restorative, and externally as an anti-septic to stop hemorrhage and to harden the skin. The physiological action of alcohol on the human body has given rise to much acrimonious debate. The intoxication arising from excess has induced many well-meaning persons to regard it with horror—the epithet "fiend alcohol" being freely applied by extreme temperance advocates; and some physicians repudiate its use even in medicine, the majority, however, regarding it as a valuable aid. Total abstainers declare that, as analysis fails to discover any element of nutriment in it, alcohol cannot be of use as an article of food; but they forget that, by its stimulating properties, it may, temperately taken, assist the stomach to properly digest the food taken. In truth, like many other things, it should be made available under the control of the reasoning and moral faculties, and its value must vary according to different constitutions. Some persons can do very well without it, and they had better do so; others find a rational use of it beneficial, and there is no reason why the benefit should not be received. Extreme advocates of total abstinence may, perhaps, be perplexed to know, on the authority of an eminent modern chemist, M. Müntz, that it is almost impossible to avoid alcohol. By the employment of very delicate tests, he has been able to detect the presence of one-millionth of alcohol when added to water. Alcohol, he asserts, is present in spring, river, sea, and rain water, excepting the very purest sea-water. There is reason to suppose that it exists in the state of vapour in the air. The diffusion of the substance in nature he explains by the destruction of organic matter by various agents of fermentation. The earth contains it, especially when rich in organic matters, and it can be extracted and its essential properties verified. A Brahmin, who conscientiously objected to the destruction of animal life for the purposes of food, was horrified when, by means of a powerful microscope, he was shown a multitude of living organisms in the water he drank; and total abstainers may be equally surprised when they are told that they breathe alcohol, drink alcohol at the bubbling spring, and that when they die they will be buried in alcoholic earth.

ALCYONIDÆ, *al-se-on'-i-de*, a genus of animals belonging to the fresh-water polyzoa, or ascidian zoophytes. (*See* ANTHOZOA, CORALS, POLYPES, SPONGES.)

ALDEBARAN, *al-de-ba'-ran*, a name given by the Arabs to a bright star of the first magnitude, situate in the southern eye of the constellation Taurus. It is the largest and most brilliant of a cluster of five stars, named by the Greeks the Hyades.

ALDEHYDE, *al'-de-hide.*—When alcohol is submitted to any process by which hydrogen is extracted from it (deoxidation, for instance), it becomes an aldehyde, every alcohol having its corresponding aldehyde. Ethylic, or vinous aldehyde, is limpid and colourless, with a peculiar and characteristic odour. Its density is ·790; it boils at 72°, and is neutral to test-paper. On exposure to the air, it absorbs oxygen, and resolves into acetic acid.

ALDER. (*See* ALNUS.)

ALEMBROTH, *a-lem'-brawth*, a compound of the bichloride of mercury and sal-ammoniac, from which is prepared the whole precipitate of mercury; the salt of wisdom of the alchemists.

ALEURITIS, *al-u'-ri-tees*, a genus of dicotyledonous plants, belonging to the order *Euphorbiaceæ*. The most interesting species is *A. triloba*, the candle-nut tree, the seeds of which contain the oil called *kukiu*, or *kekune*, which is used in some parts of the world for illuminating purposes, and which has been recommended as a substitute for castor-oil in medicine.

ALEXANDERS, a biennial plant of the natural order *Umbelliferæ*. The stem is about three feet high, the leaves are of a bright yellowish, green colour, and the flowers of the same colour. It was formerly cultivated as an edible vegetable, and the fruit has carminate properties.

ALGÆ, *al'-jee* (Lat., seaweeds), this great class of plants, belonging to the class *Cryptogamia* of Linnæus, as the Acotyledones of the natural cycles, comprehends the sea-weeds and the multifarious green vegetable forms of simple cellular structure met with in fresh water and in permanently damp situations. The humblest members of the vegetable kingdom belong to this class. Algæ are flowerless, and consequently seedless. They are propagated in various ways by reproductive particles, called spores or sporules. The class comprehends a vast variety of plants, exhibiting a wonderful multiplicity of forms, colours, sizes, and degrees of complexity in structure. These plants have, however, been arranged into three groups or orders, which have certain striking distinctive characters. These three orders are named *Rhodosporeæ*, or *Florideæ; Melanosporeæ*, or *Fucoideæ; Chlorosporeæ*, or *Confervoideæ*. *Rhodosporeæ*, or red-spored algæ, grow in salt water, and are generally rose-red or purple, rarely brown-red or greenish-red. *Melanosporeæ*, or dark-spored algæ, are marine plants of an olive-green or brown colour. *Chlorosporeæ*, or green-spored algæ, are generally green, rarely red or livid purple, found sometimes in sea-water, but more frequently in fresh-water ponds, streams, and ditches, and on damp surfaces. Professor Bentley roughly estimates the number of species of algæ at 2,500. Many are used for food in different parts of the world, their nutritious properties being due to the presence of starch, mannite, mucilage, albumen, and gelose. The ashes of several kinds of sea-weeds form *kelp*, formerly extensively used for the preparation of carbonate of soda. Iodine is obtained from sea-weeds. None of the plants in this great class are known to be poisonous.

ALGAROTH, POWDER OF, *al'-ga-roth*, a mixture of the terchloride and teroxide of antimony, invented by Victor Algarotti, a Venetian chemist, and formerly much used in medicine.

ALGEBRA, *al'-je-bra* (Arab., *al-gebr*), the science of computing abstract quantities by means of signs or symbols instead of arithmetical figures, a species of calculation which takes the quantity sought, whether it be a number or a line, or any other quantity, as if it were granted, and, by means of one or more quantities given, proceeds by consequence, till the quantity at first only supposed to be known, or at least some power thereof, is found to be equal to some quantity or quantities which are known, and consequently its own value, or quantity, or number is determined. Algebra was originally a kind of higher arithmetic, in which the numbers are replaced by symbols; but by later applications the symbols are used as well for geometrical quantities in space, or in mechanism for velocities, distances, and times, so that at present algebra occupies itself with quantities in general, whatever be their nature.

Letters and Signs.—In algebra, numbers are represented by letters. It is a method of performing calculations of all sorts of quantities by means of general signs or characters. Known quantities are generally represented by the first letters of the alphabet, as a, b, c, &c. Unknown, by the last; as x, y, z. The sign $+$ (*plus* or more) is the mark of addition. Thus, $a+b$ means that the quantities represented by a and b are to be added together. When no sign is prefixed, $+$ is understood. The sign $-$ (*minus* or less) denotes subtraction: as, $a-b$, that is, the number represented by b is to be subtracted from that represented by a. In algebraical operations the word *therefore*, or *consequently*, often occurs. To express this word, the symbol $\therefore$ is commonly used; thus, the sentence, "therefore, $a+b$ is equal to $c+d$," is expressed by $\therefore a+b=c+d$.

Algebraic Quantities.—Quantities with the sign $+$ prefixed are called positive or affirmative; and those with the sign $-$ negative quantities. The sign $\times$ (or multiplied *by*) denotes multiplication; as, 5×4 means that 5 is to be multiplied by 4. $\div$ is the mark of division; thus, $a\div b$ means that a is to be divided by b. A number prefixed to a letter is called a numeral co-efficient. When no number is expressed, 1 is understood: *i.e.*, 1 is the numeral co-efficient of such letter. A simple quantity consists of one part or term, as $+a$, $-abc$; a compound quantity of more than one, connected by the signs $+$ or $-$; as, $a+b$, $a-b+c$, are compound quantities. If there are two terms, it is called a *binominal*, if three, a *trinominal*, &c. Like quantities consist of the same letters repeated; thus, $+ab$, $-5ab$, are like quantities; but $+ab$, and $+a^2b$ are unlike quantities.

Powers of Quantities.—The powers of algebraic quantities are expressed by placing a *small figure* (equivalent to the number of factors, and called the index or exponent of the power) at the right-hand side of the letter. Thus $a\times a$, or the square of a, is expressed by a^2; $b\times b\times b$, or the cube of b, is expressed by b^3; $x\times x\times x\times x$, or the fourth power of x, is expressed by x^4; $\overline{a+b}\times\overline{a+b}\times\overline{a+b}$ or the cube of $a+b$, is expressed by $\overline{a+b}^3$, and so on.

Roots of Quantities.—The *roots* of quantities are expressed by the sign $\surd$, with the proper index annexed: thus, ${}^2\sqrt{a}$, or $\sqrt{a}$ expresses the square root of a; ${}^3\sqrt{b}$, the cube root of b; ${}^4\sqrt{a+x}$, expresses the biquadrate root of $a+x$, &c.

Equality of Quantity.—The sign $=$ placed between two or more quantities, expresses the *equality* of such quantities; thus, $a+b=c+d$, means that $a+b$ is equal to $c+d$; and $ax+by=cx+dy=2x+fy$, means that the quantities $ax+by$, $cx+dy$, and $ex+fy$, are all equal to each other. The symbol $\urcorner$ placed between two unequal quantities signifies that the first is greater than the last; thus, $a \urcorner b$, intimates that a is greater than b; but when the character is inverted, it signifies that the first quantity it less than the second; thus, $a \angle b$, intimates that a is less than b.

Operations of Algebra.—The operations of algebra are the same as those of arithmetic—addition, subtraction, multiplication, division, extraction of roots, &c. In its application to the resolution of problems, the problem must first be translated out of common into algebraic language, by expressing all the conditions and quantities, both known and unknown, by their proper characters, arranged in an equation (*see* EQUATIONS), or several equations, if necessary, and treating the unknown quantity as if it were a known one: this forms the composition. Then the resolution, or analytic part, is the disentangling the unknown quantity from the several others with which it is connected, so as to retain it on one side of the equation, while all the known quantities are collected on the other side. This process is called analysis or resolution; and hence algebra is a species of analytic art.

History.—The origin of algebra cannot be determined with exactitude. In the middle of the 4th century, when the mathematical sciences were declining, Diophantus wrote a treatise on arithmetic, in thirteen books, of which seven only remain to us. Hypatia, the daughter of Theon, who fell a victim to the fury of a mob, in the early part of the 5th century, wrote a commentary on the work of Diophantus: this, however, is also lost. In the 16th century, the works of Diophantus were discovered in the Vatican library at Rome. They were written in the Greek language, and were translated into Latin by Xylander, in 1575. A more complete translation, by Bachet de Mezeriac, appeared in 1621. In 1670, the French mathematician Fermot published notes of his own on the writings of Diophantus. The important invention of algebra, as well as numeral characters and decimal arithmetic, was first made known in Europe by the Arabians, who had collected the works of the Greek mathematicians, and translated them. By means of the Arabic tongue, Euclid was first introduced into Western Europe. The Arabians award the invention of algebra to their famous mathematician Mahommed-Ben-Musa, or Moses, who was also called Mahommed of Buziana, in the 9th century, a copy of whose treatise on the subject is preserved in the Bodleian library at Oxford. The science of algebra was originally introduced into Italy by Leonardo, a merchant of Pisa, who had spent his youth in Barbary, and there became acquainted with the Indian method of computing by nine numeral characters. He composed a treatise on arithmetic in 1202, which he afterwards revised in 1228, two centuries before the invention of printing. The manuscript was discovered in the middle of last century, in the Magliabecchian library at Florence. The first book on algebra that ever was printed was written by Lucas Paciolus, or Lucas de Borgo, a Minorite friar. It appeared in 1494 and again in 1523. It is called "Summa de Arithmetica, Geometria, Proportione, et Proportionalita." Not only are we indebted to Italy for the first European knowledge of algebra, but it was there that it received its earliest improvements at the hands of Scipio Ferreus, Florido, Tartalea of Brescia, Cardan, Lewis Ferrari, and Bombelli. Stifelius and Scheubelius, two German mathematicians, were contemporary with Cardan and Tartalea. Stifelius introduced the characters which denote addition and subtraction, and the symbol for the square root. The first treatise on algebra in English, was from the pen of Robert Recorde, a mathematician and physician of Cambridge. Vieta was the first who introduced general symbols, applicable to all problems of the same kind, without the labour of repeating the same process of analysis for each; thus happily applying algebra to geometry. The early Italian teachers described algebra as the *Arte Maggiore*, as having to do with the higher kind of calculations, or *Regola de la Cosa*, because the unknown quantity was denominated *Cosa*, the "thing," and that gave rise to the term Cossicke Art given by early English writers. Sir Isaac Newton designated it "universal arithmetic;" Sir William Hamilton "the science of pure time;" and Mr. de Morgan "the calculus of succession."

Algebraic Equation.—An equation of which the terms contain only algebraic quantities.

Algebraic Geometry is a name given to the application of algebra to geometrical problems.

Algebraic Curve is a figure the intercepted diameters of which always bear the same proportion to their respective ordinates, or the lines which, drawn perpendicular to the axis of the curve, meet the curve in a number of points.

ALGORITHM, *al'-go-rithm*, derived from the Arabic, the root being a word which means or refers to calculation or reckoning. Among many authors, and especially the Spanish, the word is naturalised, as meaning the science of numbers, or system of notation: thus, there is an algorithm of the differential calculus, an algorithm of function, &c. Though sometimes used by English writers, our language does not need it, the word *notation* being an exact equivalent.

ALHAGI, *al-hai'-gi*, Camel's-thorn, a genus of leguminous plants in the sub-order *Papilionaceæ*. The species *A. maurorum*, a native of South-Western Asia and some parts of Africa, yeilds a kind of manna, which is used as food for cattle, which is obtained by shaking the branches of the tree, and is believed by Arabian writers to be a supernatural production.

ALIMENTARY CANAL, or DUCT, *al-i-men'-ta-re* (Lat., *alimentum*, nourishment, food), is the name given to that great canal or conduit in animal bodies through which the food passes from the mouth to the anus. It distinguishes animal from vegetable life, plants having no common receptacle for their food nor canal for carrying off the excrements. In the human subject, it comprises the pharynx, œsophagus or gullet, stomach, and large and small intestines, being, in a full-grown individual, nearly forty feet in length. (*See* ANATOMY.)

ALIMENTS, *al'-i-ments* (Lat., *alimentum*, from *alo*, I nourish), a term applied to those substances which, upon being taken into the stomach, are capable of affording nourishment to the body. Every aliment must be derived from either the animal or vegetable kingdom, as the capacity of affording nourishment to the animal system would appear to belong exclusively to organized matter, or that which has possessed life. Nevertheless, certain substances appertaining to the inorganic kingdom, although incapable of themselves to form an aliment, have yet the power, when taken in conjunction with aliments, of assisting in the process of nutrition. These inorganic substances are principally water, salt, lime, &c. The first, or *Farinaceous*, class, includes barley, wheat, oats, rice, maize, potatoes, haricots, lentils, peas, &c. The second, or *Mucilaginous* class, comprehends melons, cabbages, turnips, beet-root, carrots, asparagus, &c. The third, or *Sweet* class of aliments, includes dates, apricots, dried grapes, figs, the various sorts of sugars, &c. In the fourth, or *Acidulous* class, there are grapes, strawberries, raspberries, mulberries, pears, prunes, apples, cherries, oranges, gooseberries, &c. In the fifth or *Fatty* class, there are animal fats, oils, butter, cocoa, nuts, walnuts, olives, sweet almonds, &c. The sixth, or *Caseous* class, includes the various sorts of milk, cheese, &c. In the seventh, or *Gelatinous* class, there are several kinds of fish, the flesh of young animals, calve's-feet, &c. In the eight or *Albuminous* class, there are included brain, eggs, &c. The ninth, or *Fibrinous* class, comprehends the flesh and the blood of various animals. To these nine divisions a tenth may be added, comprehending the *Condiments*, as pepper, salt, mustard, vinegar, horse radish, &c. Certain liquids, or *Drinks*, should also be reckoned among the aliments, as water of various kinds (spring-water, well-water, river-water), the infusions of tea and coffee; the various kinds of fermented liquors, as cider, perry, beer, wine, &c.; the alcoholic liquors, as gin, whisky, brandy, &c.

ALIQUANT PART, *al'-i-kwant* (Lat., *aliquantus*, a great part), a number which cannot measure any other without some remainder. Thus, 5 is an aliquant part of 12; for twice 5 wants 2 of 12, and three times 5 exceeds 12 by 3. The exact reverse of aliquot.

ALIQUOT, *al'-i-kwot* (Lat., *aliquoties*, how many times), a number or fraction which divides another number or fraction, without leaving a remainder. Thus, 6, 4, 3, 2, $1\frac{1}{2}$, $\frac{3}{7}$, and $\frac{1}{8}$, are aliquot parts of 12, being contained in it 2, 3, 4, 6, 8, 28, and 96 times. Aliquot parts are chiefly used in the rule of *Practice*.

ALISMACEÆ, *al-is-mai'-se-e*, an order of monocotyledonous plants, in the sub-class *Petaloideæ*. Swamp or floating plants, with parallel-veined leaves. Their flowers are perfect, or very rarely unisexual. The perianth is inferior, that is to say, it does not adhere to the ovary, and is arranged in two whorls, each consisting of three parts; the outer whorl being green, the inner coloured. The stamens vary in number, and there are several ovaries. Plants belonging to this order are principally found in the northern parts of the world. The typical genus is *Alisma*, the water-plantain, some species of which are well adapted for aquaria.

ALIZARINE, *a-liz'-a-reen*, a crystalline body, the pure colouring matter of madder. Purpurin and garancine are also found in this dye-stuff.

ALKALI, *al'-ka-li* (Arab., *kali*, the name of a plant from the ashes of which an alkaline substance was first procured). This term is applied, in Chemistry, to a class of substances characterised by the energy with which they combine with acids (*see* ACIDS) by their acidity and caustic property, and by their action on vegetable colours. The use of the term is now generally limited to such members of the group as are soluble in water. The alkalies proper are potash, soda, lithia, and ammonia. Potash is known as the vegetable alkali, being largely present in the ashes of plants; soda is designated the mineral alkali; and ammonia, being of gaseous form, is known as the volatile alkali. The pure form of these alkalies is called the caustic state, from the burning properties possessed by them all when not combined with any acid. When they are in combination with carbonic acid, which is a very weak acid, they are said to be in their mild form, and still preserve, in a minor degree, many of their characteristics as alkalies. Many vegetable colouring matters are changed in tint by alkaline solution, a matter of some importance in chemical analysis—vegetable blues turn green, and vegetable yellows reddish-brown. Combined with carbonic acid, alkalies are used to correct acidity in the stomach.

Alkaline Earths—Lime, magnesia, baryta, and strontia—are distinguished from alkalies proper by their carbonates not being soluble in water.

Alkaline Spectra. (*See* SPECTRUM.)

ALKALIMETER, *al-ka-lim'-e-ter* (Arab., *al-kali* and Gr., *metron*, a measure), a graduated glass tube used to determine the proportion of pure carbonate of potash or soda contained in commercial samples. (*See* ALKALIMETRY.)

ALKALIMETRY, *al-ka-lim'-e-tre*, the art of determining the proportion of caustic alkali, or alkaline carbonate, contained in commercial potash or soda, upon the amount of which depends their value for manufacturing purposes. The method by which this is effected is by adding to a certain amount of the potash or soda dissolved in water, enough dilute sulphuric acid of definite strength to exactly neutralize the alkali, and noting this quantity. For instance, if it is found that one dram of the test acid will neutralize seven grains of pure alkali, it is evident that, if six drams are required to neutralize fifty grains of impure potash, there are only forty-two grains, or 84 per cent., of pure alkali in the sample, the other 16 per cent. being combined with another acid, or replaced by some neutral compound.

ALKALOIDS, VEGETABLE, *al'-ka-loids* (Arab., *al-kali*, Gr., *eidos*, likeness).—The discovery of these substances is one of the most remarkable of modern chemistry. They are salifiable bases, found in various vegetable and animal substances, and are similar in their actions to the mineral alkalies mentioned above, uniting with acids to form salts. They are all violent poisons, highly nitrogenous, sparingly soluble in water, but more so in alcohol and dilute acids. The following is a list of the principal vegetable alkaloids. They are of great value in medicine, the exhibition of the fraction of a grain being attended with the most marked curative results. The principal vegeto-alkalies are:—morphia, from opium; quinia and cinchonia, from Peruvian bark; strychnia, from nux vomica; veratria, from hellebore; atropia and hyocyamia, from belladonna; nicotine, from tobacco; aconita, from aconite; caffeine or theime, in coffee and tea.

ALKANET-ROOT, *al'-ka-net*, a dye-stuff, giving a red colour, used for staining woods and for colouring oils and spirits used in perfumery. It is the root of the plant named by botanists *Anchusa tinctoria*. (*See* ANCHUSA.) It is used for colouring spurious port wine, and in furniture polish.

ALKANNA, *al-kan'-na* (Arabic, *al-henna*). (*See* HENNA.)

ALLAMANDA, *al-la-man'-da*, a genus of plants of the natural order *Apocynaceæ*, native of the tropical parts of America. The *A. cathartica*, indigenous to the West Indies, has strong emetic and purgative properties, and is of considerable value in medicine. The name was given in honour of Dr. Allamand, of Leyden.

ALLANITE, *al'-lan-ite*, an opaque mineral found in Greenland, consisting of oxides of iron, silica, and other substances. Named from its discoverer, Mr. Allan, of Edinburgh. (*See* ORTHITE.)

ALLIGATION, *al-li-gai'-shun* (Lat. *ad*, and *ligare*, to bind together, or unite), a rule of arithmetic by which the price of a mixture is found when the cost of the ingredients is known. This rule is divided into two cases—*alligation medial* and *alligation alternate*. The following question would belong to alligation medial. Suppose 8 gallons of brandy, at 24s. per gallon, to be mixed with 12 gallons at 34s. per gallon, what would be the price of a gallon of the mixture? But if the question were reversed, and it were required how many gallons of brandy, at 34s. per gallon, must be mixed with 8 gallons at 24s. per gallon, to make the cost of the mixture 30s. per gallon, it would belong to alligation alternate.

Rules.—To find the answer to a question in *alligation medial*, multiply each quantity by its price, and divide the sum of the products by the sum of the quantities. The solution of a problem in *alligation alternate* is obtained by arranging the given prices in one column with the proposed average prices on the left; linking each less than the average with one greater, and placing against each term the difference between that with which it is linked and the average; the respective differences will be the quantities required.

ALLIGATOR, (*See* CROCODILE FAMILY.)

ALLLIGATOR TORTOISE, (*See* TORTOISE.)

ALLIUM, *al'-li-um* (Lat., garlic), a genus of plants belonging to the natural order *Liliaceæ*, the Lily tribe. Many species are very familiar plants, being largely cultivated for the sake of their nutritious and piquant bulbs; such are *Allium Cepa*, the onion; *A. sativum*, the garlic; *A. Porrum*, the leek; and *A. ascalonicum*, the shalot. All the species are characterized by a strong, and, to some people, an extremely disagreeable odour. *Allium ursinum*, the common ramsons of our meadows, diffuses its peculiar odour through the air, and imparts its unpleasant flavour to the milk of the cows that feed upon it. The substance which gives the garlic and onion their pungent smell and flavour is a compound oil, called by chemists *sulphide of allyle*. The different species of Allium, when cultivated in warm climates, loose much of their pungency; hence the mild flavour of the Spanish onion.

ALLOCHROITE, *al-lok'-ro-ite*, a variety of garnet. (*See* GARNET.)

ALLOPHANE, *al'-lo-fain* (Gr., *allos*, other, *phaino*, I appear), the name given to a clayey mineral of a pale blue or greenish colour. Chemically, it is a hydrated silicate of alumina. It loses its colour before the blowpipe: hence its name.

ALLOTROPY, *al-lot'-ro-pe* (Gr., *allotropos*, capable of being turned from one thing into another), a term applied to a modification in the properties of a body, not resulting from chemical combination, but from the arrangement of its molecules; or, in other words, the existence of the same element in various forms, each of which, though containing no extraneous substances, possesses different properties from the other. Phosphorus, in its usual state, is a waxy, semi-transparent body, of a pale lemon-colour, which is so inflammable that the heat of the hand is sometimes sufficient to kindle it; but, by a simple though dangerous process, this substance can be procured in an allotropic state, when it is an infusible substance of a dark-red colour, which will not take fire until heated to 500° F., when it is reconverted into ordinary phosphorus. Again, iodide of mercury, when freshly sublimed, is of a lemon-yellow colour, but it becomes scarlet if pressed or agitated. Sulphur can be made to take several allotropic forms. The diamond, graphite or plumbago, and soot, are allotropic forms of the element carbon. Silica is soluble in water in one allotropic state, and insoluble in another. Oxygen and ozone afford another striking illustration of the principle. In all these cases, the change of properties is not due to the addition or subtraction of anything, but to some inexplicable molecular action. (*See* ISOMERISM.)

ALLSPICE, *awl'-spice*, the dried unripe fruit of *Eugenia Pimenta*, a plant of the Myrtle order. It is much used as a spice, and is thought to combine the flavours of cinnamon, cloves, and nutmegs; hence its common name. It is sometimes called Jamaica pepper, from the island in which it is chiefly cultivated, and sometimes pimenta.

ALLUVIUM, *al-lu'-vi-um* (Lat., *alluere*, to wash upon), in Geology, a name formerly given to those accumulations of sand, earth, and loose stones or gravel brought down by rivers, which, when spread out, form what are called alluvial plains and deltas. The term is seldom employed by modern geologists. (*See* FLUVIATILE DEPOSITS, DELTA.)

ALMANDINE, *al-man'-deen*, a gem found in Greenland, Ceylon, and the Brazils. It is an iron garnet, and consists of silica 36·3, alumina 20·56, protoxide of iron 43·2.

ALMOND, *ah'-mond*, in Botany. (*See* AMYGDALUS.)

Fixed Oil of.—An oil exuding from almonds when subjected to pressure. It is used in medicine as a mild laxative, and is sometimes administered to newly-born infants, and has a value as an ingredient in cough medicine.

Volatile, or Essential Oil of.—When the fixed oil has been expressed, the cake remaining is placed in a retort, and the volatile oil rises in vapour. When condensed, the crude oil is poisonous, but redistillation gets rid of the prussic acid. It has a use in medicine, and is employed to flavour custards and confectionery, and for scenting toilet soaps.

ALNUS, *al'-nus*, the Alder, a genus of plants belonging to the Birch order *Betulaceæ*. The species *A. glutinosa* is a well-known tree. Its timber resists the destructive action of water for a long time, and on this account is much used for the piles of bridges. Its bark is astringent, and has been employed in medicine and for tanning; it is also used as a dye-stuff, giving a red colour when alone, and black when added to a solution of copperas. It is a low tree with a rugged bark, and grows in moist situations. The leaves are roundish, waved, serrated, and somewhat sticky, being downy underneath about the veins. The flowers grow in long hanging catkins. The species *A. incana* is found in Kamtschatka, where its bark is used for making a kind of bread.

ALOE, *al'-o* (Lat.), a genus of monocotyledonous plants belonging to the natural order *Liliaceæ*, the Lily tribe. There are several species, all natives of warm climates, but capable of being cultivated in colder regions as ornamental garden plants. The leaves are succulent, and edged with spines; they yield the juice which, when inspissated, constitutes the bitter drug called aloes (*see* this word). The flowers are usually red, growing in a bunch at the top of the stem. Some of the larger kind of aloes are of great importance to the inhabitants of countries in which they grow. In the arts, a particularly beautiful violet colour is obtained from the leaves of the Socotrine aloe (*A. Socotrina*). Mohammedan pilgrims suspend an aloe over their doors on their return from Mecca, to signify that they have performed the pilgrimage. The perfume of aloes is mentioned in the Old Testament and in the Gospel of St. John.

Aloe, the American.—(*See* AGAVE.)

Aloes, a drug used medicinally in small doses as a tonic, and in larger doses as a purgative and cathartic. It is the inspissated juice of the leaves of various species of *Aloe*.

Aloes Wood.—The inner part of the trunk of trees of the natural order *Aquilariaceæ*, natives of the tropical part of Asia, and supposed to be the lign (*lignum*) aloes of the Old Testament. It contains a fragrant resinous substance used in the East as a medicine. By the ancients it was esteemed to be as valuable as gold, and fragments worn about the person were supposed to ensure beneficial results; and it was also used as a setting for precious gems.

ALOYSIA, OR LIPPIA, *a-loi'-si-a*, a genus of plants belonging to the natural order *Verbenaceæ*. *Aloysia*, or *Lippia citriodora*, is the sweet verbena or lemon-plant of our gardens.

ALPACA, *al-pak'-a*, a species of the genus Lama, with which it is so closely allied, that by some it is set down as being only a variety of it. The alpaca (used by the ancient Peruvians as a beast of burthen) inhabits the mountainous parts of Peru, and obtains its aliment from the coarse and scanty herbage growing on the sterile soil of those elevated regions. Its general form bears a close resemblance to that of the sheep, but its head and neck more nearly resemble those of the camel. The upper part and sides of this animal's body are covered with light chestnut-brown wool, which hangs down in slightly curled meshes almost a foot in length. This wool is extremely soft and elastic, and is nearly as fine as that of the Cashmere goat. The face, up to the posterior margin of the jaws, has short smooth hair; but, from the forehead, a stiff silky hair falls over the eyes. The shearing of the wool takes place annually, from 10 to 12 lbs. of wool being obtained from a single animal. Efforts, only partially successful, however, have been made to acclimatize the alpaca in Europe. The first alpaca brought to this country was placed in the menagerie of the Earl of Derby, in 1836.

ALPINE PLANTS (by some botanists designated Alpestris), plants which are found at elevations approaching the limits of perpetual snow in alpine regions. The snow line varies considerably in different parts of the world. (*See* PHYSICAL GEOGRAPHY.) Rhododendrons, gentians, saxifrages, ferns, and mosses, and beautiful cryptogamous plants are familiar forms of alpine vegetation.

ALPINIA, *al-pin'-i-a* (from Prosper Alpin, a celebrated botanist), a genus of aromatic herbaceous plants, in the natural order *Zingiberaceæ*, the Ginger tribe. The roots of the species *A. galanga* and *A. chinensis* constitute respectively the Java and Chinese, or greater and lesser galangals. These roots have similar properties to ginger, and are used for the same purposes. The ovoid China cardamum, used in veterinary medicine, is the fruit of *A. alba*. The seeds of this plant are commonly employed as a condiment by the Chinese.

ALSINEÆ, *al-sin'-e-e*, the Chickweed sub-order of *Caryophyllaceæ*. There are numerous genera; *Alsine*, *Cerastium*, *Arenaria*, and *Stellaria*, being examples. (*See* CARYOPHYLLACEÆ.)

ALSODEÆ, *al-so'-de-e*, in Bot., one of the two sub-orders into which the natural order *Violaceæ* has been divided. The species have regular flowers, with anthers not furnished with appendages. (*See* VIOLACEÆ, VIOLEÆ.)

ALSTONIA, *al-sto'-ne-a*, a genus of dicotyledonous plants, belonging to the natural order *Apocynaceæ*, the Dog-bane tribe. The species *A. scholaris* has a bitter tonic astringent wood, and is a native of South America.

ALSTRŒMERIA, *al-stre-meer'-i-a*, a genus of plants belonging to the Amaryllis order, or *Amaryllidaceæ*. The species are all South American. Their leaves are twisted, so that what should be the upper surface becomes the lower; the tuberous roots are eaten; and in Chili a kind of arrow-root is prepared from them.

ALTERNATION, *al-ter-nai'-shun*, in Mathematics, a term applied to the changes of orders in any number, called also Permutation. It is found by a continual multiplication of all the numbers; thus, to know how many changes can be rung on six bells, multiply the numbers 1, 2, 3, 4, 5, 6 continually into one another, and the last product is the answer.

Alternation of Generations. (*See* GENERATIONS, Alternation of.)

ALTERN BASE, *awl'-tern*, in Mathematics, a term used in contradistinction to the true base. Thus, in oblique triangles, the true base is either the sum of the sides (the difference of the sides then forming the true base), or the true base is the difference; in which case the sum is the altern base.

ALTHÆA, *al-the'-a* (Gr., *altheo*, I heal), the marsh-mallow, a genus of plants belonging to the natural order *Malvaceæ*. (*See* MARSH-MALLOW.)

ALTITUDE, *al'-ti-tude* (Lat., *altitudo*, height), is the height of a celestial body above the horizon. It is measured by the angle which a line from the eye to the star or planet makes with the horizontal line. An altitude may be *true* or *apparent*. If it be taken from the real horizon, the altitude is true; if from the apparent or sensible horizon, the altitude is apparent; or rather, the apparent altitude is that which appears to our observation, and the true is that from which the refraction is subtracted. The true altitudes of the heavenly bodies differ but little from their apparent altitudes, on account of their distance from the earth's centre, and the smallness of the earth's semi-diameter compared thereto. In observatories, altitudes are taken by means of telescopes attached to graduated circles, and at sea, by instruments called sextants.

Altitude, in Geometry, one of the dimensions of a body, being the same with what is commonly called height. The altitude of a figure is the distance of its vertex from its base; in other words, it is the length of a perpendicular line let fall from the vertex to the base. The altitude of a cone is measured by a line perpendicular to the plane of the base, drawn between the vertex and base of the cone.

ALUM, *al'-um* (Lat., *alumen*), a salt consisting of sulphate of alumina in combination with sulphate of potash, soda, or ammonia. Potash and ammonia alum are used in dyeing, in calico-printing, in paper-making, in the manufacture of colours, and in medicine. Alum is obtained by submitting alum-shale, or alum-slab, which consists of alumina, iron pyrites, and coaly matter, to the action of fire in enormous heaps for one or two years. During the combustion, the sulphur of the iron pyrites (sulphide of iron) combines with the oxygen and alumina, forming sulphate of alumina, which is dissolved out of the cooled mass by water. This solution is then converted into alum by the addition of either sulphate of potash or sulphate of ammonia, the latter being most generally used on account of its cheapness. Ammonia alum is more valuable than potash alum, from containg 11·90 per cent. of alumina, which is the active ingredient, while potash alum contains but 10·82 per cent. Soda alum is not used in the arts. The great use of alum in dyeing and printing is on account of the property possessed by alumina of uniting with and precipitating certain vegetable substances in an insoluble form. Alum is also used in the preparation of leather; and in medicine is a powerful astringent. Alum rarely occurs in nature, except in a few springs and some extinct volcanoes, where it appears to have been formed by the action of the vapours of sulphuric acid. Muslin dipped in a solution of alum is rendered incombustible.

Alum-Root, a name given to the root of the *Geranium maculatum*, which contains much tannin. It is used in North America as an astringent.

Alumstone or **Alunite.**—A mineral found near Civita Vecchia, in Georgia, at Pic-de-Lancy, in France, and in the Grecian archipelago. It consists of alumina 37·13, sulphuric acid 38·53, potash 11·34, and water 13. It is one of the principal sources of alum.

ALUMINA, *a-lu'-mi-na*, the sesqui-oxide of the earth-metal aluminium, the principal constituent of clays. It occurs in nature in combination with silica and other bases. Felspar is a silicate of alumina and potash. (*See* FELSPAR and GRANITE.) The hydrate is obtained in the form of a gelatinous precipitate, by adding ammonia, or carbonate of ammonia, to a solution of alum. By drying and igniting, it is changed into the anhydorus sesqui-oxide, insoluble in water, but soluble in acids and alkalies. Mr Walter Crum has discovered a modification or allotropic condition of alumina, produced by igniting bi-acetate of alumina, which is soluble in water, and forms a translucent coagulum with dye-woods. By the addition of a small quantity of acid, alkali, or even neutral salt precipitation of alumina, a third allotropic condition takes place; this form being insoluble in acids, but soluble in alkalies. By the use of the oxy-hydrogen blow-pipe, aluminum is fusible. It occurs in nature in a crystallized form, the coarser specimens forming emery powder. The transparent crystals when of a blue colour, owing to a haze of metallic oxide, constitute the sapphire, and when red, the ruby.

Acetate of.—The acetate of alumina is much used in the arts on account of the easiness with which it parts with its alumina. It is formed by adding acetate of lead to sulphate of alumina, and filtering off the insoluble sulphate of lead.

Silicate of.—The chief ingredient in common clay.

ALUMINIUM, *al-u-min'-i-um*, a white, malleable ductile metal, dicovered by Wöhler in 1827. It is now regularly prepared as a commercial product in the following manner:—Anhydrous alumina is mixed with charcoal and oil, and ignited in a covered crucible. When cold the mass is broken to pieces, and exposed at a red heat to the action of chlorine gas. Chloride of aluminium is formed, and, when cold, is mixed with half its weight of chloride of sodium and fluor spar. This mixture is placed in a crucible with one-eighth of metallic sodium, and heated to the melting-point of the materials employed. The sodium seizes on the chlorine, leaving the aluminium in a refined state. Aluminium thus prepared is a bluish-white metal, similar to silica. It becomes as hard as iron on being hammered and rolled. Its extraordinary lightness, 2·5 (the specific gravity of glass) has led to its employment in jewellery. It forms a hard gold-coloured alloy with copper, called aluminium bronze. Added to iron in the proportion of 25 per cent., it prevents the oxidation of that metal by moist air.

ALVEOLA, *al'-ve-ol-a* (Lat., *alveolus*, a small hollow vessel), a term applied by botanists to any little pit or socket, but particularly to a cavity in the receptacle where the seed is placed.

ALYXIA, *a-lix'-i-a*, a genus of dicotyledonous plants, belonging to the Dog-bane order *Apocynaceæ*. The species *A. stellata* has an aromatic bark, resembling in properties that of canella.

AMADOU, *am'-a-doo* (Lat., *ad manum dulce*, soft to the touch), a spongy substance, generally known as German tinder, which can be ignited by a spark from a flint and steel. It is prepared by soaking thin slices of the fungi *Polyporus fomentarius* (which grows on old trees, especially the oak, ash, fir, and cherry), in a solution of nitrate of potash (saltpetre), after they have been softened by beating with a mallet. Similar slices not treated with the salt are sometimes used in surgery to give support to affected parts, and also to restrain hemorrhage. The fungi *Pigniarius*, a hard amadou, is known as touchwood. When impregnated with gunpowder, the prepared fungus forms black amadou. (*See* POLYPORUS.)

AMANITA, *am-a-ni'-ta*, a genus of fungi, named from Mount Amanus, in Cilicia, where they were very abundant. The species have a close resemblance to some edible fungi, and are not unlike the common English mushroom. *Amanita muscaria* is a very poisonous kind, though the natives of Kamtschatka are in the habit of eating it for the sake of its narcotic effects. It is sometimes called Fly Agavic, and it is steeped in milk and employed to kill insects.

AMARANTHACEÆ, *am-a-ran-thai'-se-e*, the Amaranth order of dicotyledonous plants. There are 46 genera and 486 species, herbs or shrubs, nearly all natives of tropical regions.

AMARANTHUS, *am-a-ran'-thus*, the typical gen. of the nat. ord. *Amaranthaceæ*. Some of the species have bright-coloured persistent flowers, and have been introduced into this country as ornamental garden plants. The best-known are *A. caudatus* (Love lies bleeding), *A. hypochondriacus* (Prince's feathers). In poetry the name is applied to plants which, from not soon fading, typified immortality; and for that perhaps the Globe Amaranth, the purple flowers of which retain their beauty for several years, is much used in Roman Catholic countries for the decoration of churches.

AMARYLLIDACEÆ, *am-a-ril-li-dai'-se-e*, the Amaryllis order of monocotyledonous plants. There are 68 genera and 400 species, natives of many parts of the world, but most abundant at the Cape of Good Hope. Several of these plants have poisonous properties, and some yield excellent fibres. The different species of NARCISSUS belong to this order.

AMARYLLIS, *am-a-ril'-lis*, the typical genus of the natural order *Amaryllidaceæ*. Several beautiful garden and greenhouse plants are included in this genus. They are remarkable for their brilliant and symmetrical flowers, which exhale a sweet perfume. The Guernsey lily (so named from its successful cultivation in that island, but supposed to be a native of Japan), belongs to this species.

AMAUROSIS, *am-aw-ro'-sis* (Gr., *amaurosis*, obscurity), is a blindness or obscurity of vision, proceeding from a diseased state of the optic nerve, or of that part of the brain in connection with it. It generally comes on gradually, with dimness or confusion of sight, variations of colour, or the presence of floating objects called *spectra*. It is commonly occasioned by long-continued over-excitement of the organs of vision, or by a sudden exposure to a bright light, or it may proceed from a disordered state of the stomach. The use of tobacco is one of the predisposing causes. It is also sometimes hereditary. It may be permanent, or only temporary. In a full habit, it is to be treated by depletion; in the weak, by tonics and alteratives. Counter-irritants are also to be used.

AMBER, *am'-ber* (Fr., *ambre*, Gr., *elektron*), a resinous mineral solid, of a fine yellow colour, which, on being rubbed, becomes strongly electric. It has given its name to the science of electricity, being the first substance which was found to possess such properties. It is much used for jewellery and pipe mouthpieces. Dissolved in chloroform, it forms one of the best photographic varnishes. It is found abundantly on the shores of the Baltic, and, occasionally, in Greenland, England, Italy, Spain, Sicily, Siberia, China, and America. It is supposed to be a fossil gum or resin, from its constituents and properties, and from containing the bodies of insects, and sometimes leaves, inclosed in its mass. There are amber mines on the Baltic coast of Prussia, worked to the depth of 100 feet. Pieces of amber weighing as much as 12 lbs. have been found. Greek legends describe amber as the tears of the sisters of Phaethon who were killed by the lightnings of Jove for his presumption in attempting to drive the chariot of the sun-god, one of whose names was Electron. Medicinal virtues were formerly ascribed to amber, and it was believed to be a charm against witchcraft.

AMBER, ACID OF. *See* SUCCINIC ACID.

AMBERGRIS, *am'-ber-gris* (Fr., *ambre*, amber; *gris*, grey), is a morbid secretion of the sperm whale, much used in perfumery, found floating on the sea, or deposited on the coast. It imparts a delicate odour to perfumes. In the East it is used as a flavouring material in cookery.

AMELANCHIER, *am-e-lan'-she-er*, a genus of plants belonging to the sub-order *Sanguisorbeæ*, of the natural order *Rosaceæ*. The species *A. canadensis* is a native of the arctic regions, and its fruit, called the shad-berry, or service-berry, is used for mixing with pemican.

AMENTACEOUS, *a-men-tai'-se-us*, a term applied to those plants which bear catkins (*see* AMENTUM), as the oak, willow, poplar birch, and walnut.

AMENTUM, *a'-men-tum*. (*See* CATKIN.)

AMETHYST, *am'-e-thist* (Lat., *amethystus*), a variety of crystallized quartz, having a violet tint, due to a small quantity of paroxide of iron or of manganese. The most beautiful specimens are obtained from Ceylon, India, and Brazil. It is also found near Cork, in some parts of Scotland, in Saxony, and in Transylvania. The Oriental amethyst is a purple variety of the sapphire, and consists of alumina, with a small portion of oxide of iron.

AMIANTHUS, *am-i-an'-thus*, a fine variety of asbestos. (*See* ASBESTOS.)

AMIDINE, *am'-i-dine*, the soluble portion of starches.

AMIDOGEN, *a-mid'-o-jen*, a chemical base containing three equivalents of hydrogen to one of nitrogen. It is produced by the action of the metal potassium on dry gaseous ammonia.

AMMONIACUM, *am'-mo-ni'-a-kum*, a gum-resin used in medicine. It exudes from the stem of an umbelliferous plant known to botanists as *Dorema ammoniacum*, which grows in Persia and the adjacent parts of Asia. It is occasionally prescribed as an expectorant, and is applied externally to promote the absorption of tumours and chronic swellings of the joints.

African Ammoniacum is a very different substance, the product of a plant growing in North Africa. It is a dark-coloured gum resin, and is used, especially in Egypt, for purposes of fumigation.

AMMONITE, *am'-mo-nite*, a genus of fossil shells allied to the living genus Nautilus. In shape they resemble a ram's horn—whence their name, from their supposed likeness to the horns upon the statue of Jupiter Ammon. Having, also, very much the appearance of a coiled snake, they were, before the science of geology was known, commonly described as petrified snakes. More than 200 species are known. They are found plentifully in the cretaceous oolite formations, and in the entire series of fossiliferous rocks, and are so abundant in some parts of Burgundy, that the roads are paved with them. They vary in size from two or three inches to three or four feet in diameter. The animal that inhabited this shell was provided with air-sacs, by means of which it could rise or sink in the water; and its shelly covering, necessarily delicate in order to float, was made strong enough to bear the pressure of great depths by its tubular form and internal ribs or supports.

AMMONIUM.—The existence of a hypothetic compound metal called ammonium, and having the constitution NH_4, has been assumed as the only method of explaining the perfect analogy that exists between the salts of ammonia and those of the various metals. An equivalent of ammonia united to an equivalent of water is supposed to form the oxide of this metal, $NH_3+HO=(NH_4)O$, corresponding to potassa, the oxide of potassium KO. The theory of the existence of a compound metal is borne out not only by analogy, but by actual experiment. If a few globules of mercury are immersed in a solution of chloride of potassium, and an electric current be passed through them, the mercury gradually swells up into a pasty mass, which experiment has proved to be an amalgam of mercury and potassium. If chloride of ammonium be substituted, the same effect takes place, the only difference being that the bulk of the mercury is much more increased, and at last floats on the solution, from its lightness. The formation of this amalgam seems not only to demonstrate the existence of ammonium, but also to show that it is a metal, non-metallic amalgams being unknown. When thrown into water, these amalgams form solutions of potash and ammonia respectively, with the evolution of hydrogen.

AMMOPHILA, *am-mof'-e-la*, a genus of grasses closely allied to the reeds. *A. arundinacea*, commonly known as sea-reed, sand-reed, or mat-grass, grown on the sandy shores of Britain and the continent of Europe. In Ireland it is used to make mats. In English and Scotch law it is described as Marum, or Marrum, and its destruction was prohibited under severe penalties, because of its great utility in fixing the shifting sand.

AMOMUM, *a-mo'-mum*, a genus of plants belonging to the natural order *Zingiberaceæ*, the Ginger family. Several species have aromatic seeds, which are used medicinally and as spices in many parts of the world. *A. meleguela* is a native of Western Africa, and yields the so-called grains of Paradise, or Guinea pepper, used in this country in veterinary medicine, and for giving pungency to beer, wine, spirits, and vinegar. Most of the fruits called cardamoms, so largely employed in medicine as stimulants, are produced by plants included in this genus. So also is the species known as the grains of Paradise.

AMORPHA, *a-mor'-fa*, the bastard indigo, a genus of plants belonging to the natural order *Leguminoseæ*. The typical species, *A. fruticosa*, is a native of South Carolina, and is cultivated in English gardens. Its flower is purple or violet, and very irregular, the corolla wanting both wings and keel; its leaf is very dark green. The root, when peeled, is sometimes chewed as a remedy for toothache. A blue dye-stuff resembling indigo, but much inferior, may be obtained from this plant; hence the common name for the genus.

AMORPHOUS, *a-mor'-fus* (Gr., *a*, without, *morphe*, form), in chemistry and mineralogy, substances are said to be *amorphous* when they do not assume any crystalline form or regular structure. Glass, resin, coal, and albuminous substances are amorphous, exhibiting uniformity of properties in every direction.

AMPELIDEÆ, *am-pe-li'-de-e* (Gr., *ampelos*, vine), in Bot., a name given by some botanists to the Vine order. (*See* VITACEÆ.)

AMPELOPSIS, *am-pe-lop'-sis*, in Bot., a genus of plants belonging to the natural order

Vitaceæ, the Vine family. The species constitute the climbing shrubs called Virginian creepers.

AMPHIBIA, *am-fib'-i-a* (Gr., *amphi*, both, and *bios*, life), an order of the class of Reptiles. In ordinary language, the term amphibious has been applied to animals such as frogs, which at one period of their existence are aquatic, breathing by means of gills, and which at another period of their life respire air, and are frequently on land; to animals such as seals, which, although breathing by means of lungs, are yet capable of remaining under water for some time; to various terrestrial animals, such as the hippopotamus, which frequent an aquatic medium. In the system of Linnæus the amphibia comprehended the whole of the animals now known as reptiles; such as serpents, frogs, tortoises, and lizards, and even the cartilaginous fishes; but according to later naturalists, the term amphibia has been restricted to that order of reptiles called Batrachians; for this reason, that these animals breathe by means of gills in their earliest or tadpole condition, and afterwards acquire lungs, and respire air on assuming their perfect form as reptiles. (*See* BATRACHIANS, FROG, SALAMANDER, SIREN, PROTEUS.)

AMPHIBRYA, *am-fi-bri'-a* (Gr., *amphi*, around, *bryo*, I grow), the name given by Endlicher to a section of the vegetable kingdom, corresponding with the *Monocotyledones*, or the divisions *Rhizogens*, *Endogens*, and *Dictyogens*.

AMPHIOXUS, *am'-fi-ox'-us*, a remarkable species of fish. (*See* LANCELET.)

AMPHISARCA, *am'-fi-sar'-ka*, a many-celled fruit like that of the Baobab.

AMPHISBŒNA, *am'-fis-be'-na* (Gr., *amphi*, and *baino*, to go), a genus of animals belonging to the order of lizards, found only in South America and the West Indies, but having the general appearance of snakes or worms. They are about 20 inches long, burrow in the soft earth, and appear to move with equal facility in either direction. Their food consists of ants and other small animals.

AMPLEXICAUL, *am'-plex'-i-kawl* (Lat., *amplecti*, to embrace, *caulis*, a stem), a term applied to a leaf which is enlarged at its base, so as to clasp the stem from which it springs, as in fool's parsley.

AMPLITUDE, in Astronomy, is the distance of a heavenly body, at the time of its rising or setting, from the east or the west point of the horizon.

AMYGDALEÆ, OR DRUPACEÆ, *am'-ig-da'i-le-e* (Lat., *amygdala*, an almond), a sub-order of the natural order *Rosaceæ*. It includes most of our stone-fruit trees, as the almond, the plum, and the cherry. The seeds, flowers, leaves, and young shoots of many of the *Amygdaleæ*, when moistened with water, yield hydrocyanic, or, as it is commonly termed, prussic acid. Their barks have generally astringent and febrifugal properties, and yield a kind of gum.

AMYGDALIN, *am-ig'-da-lin*, a white crystalline solid, found in bitter almonds, peach-kernels, and laurel-leaves. By the action of the alkalies amygdalic acid may be formed. Sweet almonds contain no amygdalin.

AMYGDALOID, *a-mig'-da-loid*, a rock consisting of a basis of some kind of trap rock, commonly of greenstone, forming numerous small almond-shaped cells, filled with nodules of calcareous spar or zeolotic minerals. These nodules are evidently the result of imperfect crystallization.

AMYRIDACEÆ, *am-i-ri-dai'-se-e*, the Myrrh and Frankincense order, consisting of trees and shrubs remarkable for the abundance of their fragrant balsamic or resinous juice. There are about 50 species known, all natives of tropical regions. The most important are described under the heads of the genera to which they belong.

AMYRIS, *am'-i-ris*, a genus of tropical plants belonging to the natural order *Amyridaceæ*. Many species yield fragrant resins, and *A. balsamifera* is said to furnish, besides, a kind of rosewood.

ANABASIDÆ, *an-a-bas'-i-de*, or Labrinthibranchidæ, a family of fresh-water fishes, natives of the south-east of Asia, and of South Africa. They are characterized by a remarkable structure of the upper membrane of the pharynx, which contain cellular reservoirs, by means of which sufficient water is retained to keep the gills moist for a considerable time, and so enable the fish to subsist out of water and travel some distance on dry ground. The climbing perch of India (*Anabass-candens*) is a well-known member of this family.

ANABLEPS, *an'-ab-leps* (Gr., to look up), a genus of fishes of the order *Malacopterygii Abdominales*, characterized by a very peculiar structure of the eyes, each eye having two pupils. The best known species inhabit the rivers of Guiana and Surinam.

ANACARDIACEÆ, *an-a-kar'-di-ai'-se-e*, the Cashew-nut, or Sumach order of plants. There are 49 genera and about 100 species, nearly all of which are natives of tropical regions. They yield, by exudition, resins and gums, or acrid and occasionally poisonous juices. The fruits and seeds of some species are edible.

ANACARDIUM. (*See* CASHEW-NUT.)

ANACONDA, *an-a-kon'-da*, an enormous snake, sometimes measuring 30 feet in length, frequenting the swampy districts of South America, and feeding on water animals. It is not venomous, but its great size makes it an object of terror. The colour of the body is rich brown, with bright orange rings on each side, and two rows of large black spots along the back. An oil, prized by the natives, is obtained from the carcase.

ANACYCLUS, *an-a-si'-klus* (Gr., *ana*, in the form of, and *kyklos*, a circle), a genus of plants belonging to the natural order *Compositæ*. The root of *A. pyrethrum*, pellitory of Spain, is employed in medicine as an energetic local irritant and sialogogue, its properties depending on the presence of a volatile oil.

ANÆMIA, *a-ne'-mi-a* (Gr., *a*, not, and *aima*, blood), a term used to denote a deficiency of the red globules or colouring matter of the blood. It is characterized by a pale waxy complexion, and a pallor in those parts, as the lips, which are generally suffused. It is to be treated with pure air, nourishing diet, and tonics, such as iron.

ANAGYRIS, *an-aj-i-ris* (Gr.), a genus of leguminous plants. The seeds of *A. fœtida* are very poisonous.

ANAL GLANDS, glands differing in character, found in many animals, and generally characterized by the disagreeable odour of their secretia, they are of frequent occurrence among carnivora and rodents. The secretion peculiar to polecats, skunks, and badgers, which they use as an instrument of defence, shielding themselves from their adversaries by an overpowering and intolerable odour, comes from a pouch situated beneath the tail, and the civet cat has four glands of this character. Anal sacs are possessed by the crocodile and some serpents.

ANALCIME, *a-nal'-seem*, a silicate of soda and alumina, remarkable for peculiar optical properties possessed by it. (*See* POLARIZATION OF LIGHT).

ANALOGUE, *an'-a-log*. In comparative anatomy, glans are analogous to each other, or analogue, when they perform similar functions, although different in structure, as the wings of a bird and the wings of an insect. (*See* HOMOLOGUE.)

ANALYSIS, *a-nal'-i-sis* (Gr., *analyo*, I loosen or untie), is a method of reasoning by which we resolve or separate a whole into its constituent parts, and is opposed to SYNTHESIS, in which the parts are collected into a whole.

In Mathematics, the method of analysis practised by the ancient writers consisted in its application to the solution of geometrical questions. Modern mathematicians, in applying the analytical process, treat all quantities as unknown numbers, and represent them for this purpose by symbols, the relations subsisting between them being thus stated and subjected to further investigation.

ANAMIRTA, *an-a-mir'-ta*, a genus of plants, belonging to the natural order *Menispermaceæ*. The species *Anamirta paniculata*, or *cocculus*, is a beautiful climbing plant, which is a native of the Malabar coast and the Indian archipelago. Its fruit is poisonous. (*See* COCCULUS INDICUS.)

ANANASSA, *an-a-nas'-sa*, a genus of plants belonging to the natural order *Bromeliaceæ*. The species *A. sativa* furnishes the delicious fruit known as the pine-apple. (*See* PINE-APPLE.)

ANAS, *a'-nas*, a genus of birds included in the order *Palmipedes*, web-footed birds. (*See* DUCK, EIDER, GOOSE, SWAN, &c.)

ANASTATICA, *an-a-stat'-i-ka* (Gr., *anistemi*, I rise again), a genus of cruciferous plants. The principal species is *A. hierochuntina*, the rose of Jericho, which is found in the deserts of Egypt and Syria. This plant is remarkable for its hygrometric properties; thus, when full grown, and its branches have become dry and withered, it contracts so as to assume the form of a ball, in which state it is blown hither and thither by the winds; but, if it then meets with any moisture, it uncoils and for a time seems to regain life.

ANASTOMOSIS, *an'-as-to-mo'-sis* (Gr., *ana*, through, and *stoma*, a mouth), a term used in Anatomy to denote the communication of the blood-vessels with each other. The necessity of a constant supply of blood to every part of the human body has led to a wise provision, by which, though even one of the larger arteries become obstructed, there are numerous smaller ones communicating with the same part, which, by the increased pressure upon them, become enlarged, and supply its place.

ANATOMY, *a-nat'-o-me*, is a term derived from the Greek verb *anatemno*, I cut up, and literally signifies the separation of a thing into parts by cutting. In the more usual acceptation of the word it denotes the science which determines the construction, the form, and the structure of organized bodies. All material substances either are or have been, or are not and have not been, possessed or endowed with life. The former have an organized structure, in which, in the living state, changes take place, and processes are carried on necessary to their existence. The latter are composed of homogeneous particles, and are subject only to mechanical or chemical changes. In the former are comprehended all plants and animals, in the latter all mineral or inorganic substances. It is to the former of these two great divisions that the term anatomy is applied. It is the art of dissecting organized bodies for the purpose of ascertaining their internal structure; it is also the science which deals with the knowledge thus acquired, and deduces general principles from it. As organized bodies naturally form themselves into two distinct classes—plants and animals; so we have *vegetable anatomy*, or the anatomy of plants, and *animal anatomy*, or the anatomy of animals. Animal anatony, again, is subdivided into *comparative anatomy*, which treats of the structure of all animals except man, and *special anatomy*, which deals with the structure of one animal only. Human anatomy treats of the several parts and organs of the human body, in respect to their form, structure, and relation to each other. It is usually divided into *general*, *descriptive* or *physiological*, and *pathological*. General anatomy treats of the nature and general properties of the separate substances of which the body is composed, not as these exist combined in special organs, but as they form distinct and peculiar substances. Descriptive anatomy comprehends a description of the several parts and organs of the body, with an account of their situation, connections, and relations, as existing in the natural and healthy state. Pathological, or morbid anatomy, traces and describes the changes produced by disease upon healthy structures, whether existing in individual organs, or in the primitive or common substances of which these organs are composed. As an account of the various parts and organs of the human body, as well as of the diseases to which they are subject, will be found under their several names, in other parts of this work, it is unnecessary to do more here than give a short summary of the subject, referring to these articles for more special information.

General Anatomy.—The human body consists of solid and fluid substances, the fluid bearing to the solid parts a general ratio of from 7 to 1 to 9 to 1. The fluids of the body are various, but may be divided into three classes:—the circulating nutritious fluid called the blood; the fluids which are incessantly poured into it for its renewal, viz., the chyle and lymph; and the fluids which are separated from it by secretion, as saliva, bile, gastric juice, &c. The blood is that well-known red fluid which, by means of the heart, arteries, and veins, circulates through all parts of the system, and supplies the waste that is constantly going on. The chyle is a milky fluid, separated from the chyme or digested food after it has passed from the stomach into the small intestines, and become mixed with the bile and pancreatic juice. It is absorbed by the lacteals, and conveyed by ducts or canals to the *receptaculum chyli*, where it is taken up by the thoracic duct, and poured into the blood. The lymph is a colourless fluid, like water, taken up by the lymphatic vessels, which pervade almost every part of the body. It seems to differ little from chyle, except that the latter contains a greater preponderance of fatty matter.

The greater portion of the lymph is poured into the receptaculum chyli, where it becomes mixed with the chyle, and is carried with it into the blood; that, however, collected from the right side of the head and chest, and right upper limb, is conducted into the right subclavian vein, by the right lymphatic or right thoracic duct. The secretions are those fluids secreted or separated from the blood. The term is sometimes used to include the excretions which are thrown off from the body as useless or noxious, as urine from the bladder, or perspiration from the skin; but it is properly applied only to such products as are secreted from the blood, but still retained in the system for the performance of certain subordinate actions. These are—1, saliva, secreted by the salival glands of the mouth; 2, gastric juice, by the stomach; 3, pancreatic juice, by the pancreas; 4, bile, by the liver; 5, tears, by the lachrymal gland: 6, milk, by the mammary glands; 7, semen, by the testes; 8, oil, by the vessels of the adipose tissue; 9, synovia, by the synovial glands of the joints; and 10, mucus, by the mucous glands.

The organized solids of the human body are usually divided into the following seventeen elementary tissues:—1. Bone, or osseous tissue, which forms the framework of the body, to which the other structures are attached, or in which they are contained. 2. Muscular tissue, consisting of fine fibres, which are for the most part collected into distinct organs called muscles, by means of which the active movements of the body are performed. 3. Adipose tissue, which constitutes the fat of the body as well as the marrow of the bones. 4. Areolar, cellular, or connective tissue, a soft filamentous substance of considerable tenacity and elasticity, which is extensively distributed over the body, and forms the connecting medium of all the other tissues. 5. Fibrous tissue, formed of a number of minute fibres running chiefly parallel to each other, and sparingly supplied with blood-vessels or nerves, and used for connecting, enveloping, or binding together, various parts of the human body, as tendons, ligaments, fasciæ, periosteum, perichondrium, dura mater. 6. Elastic, or yellow tissue, characterized by possessing a high degree of elasticity, and employed wherever that quality is required, as in forming the spinal ligamenta-subflava. 7. Cartilage, an opaque substance, usually of a pearly or bluish-white colour but sometimes yellow, covering the articular extremities of the bones, connecting the surfaces or margins of immovable bones, or lining the walls of certain cavities, also found in the ear, nose, larynx, &c. Fibro-cartilage is, as its name indicates, a structure intermediate between fibrous tissue and cartilage, partaking, in some measure, of the firmness of the one with the elasticity of the other. 8. Nervous tissue, which goes to form the nervous system. 9. Blood-vessels, comprising the arteries by which the blood is conducted from the heart to all parts of the body: the veins, by which it is brought back again to the heart: and the capillaries, minute vessels by which it is carried from the extremities of the one to those of the other. 10. Absorbent vessels and glands, comprising the lacteals and lymphatics, together with the glands in connection with them. 11. Serous and synovial membranes, which resemble each other in general form and structure, but are distinguished by the nature of their secretions; the former lining the cavities of the body which have no outlet, as the peritoneum in the abdomen, the pleuræ and pericardium in the chest, and secreting a transparent and nearly colourless fluid, which moistens the surface; the latter lining the cavities of the joints, and secreting a viscid fluid which lubricates their surface. 12. Mucous membrane, which lines those internal passages of the body exposed directly or indirectly to contact with the atmosphere, and secretes a fluid of a more consistent and tenacious character than the serous membranes. 13. Secreting glands, a class of organs widely differing from each other in their nature and form, but all devoted to the function of secretion. 14. Vascular or ductless glands, so called from their general resemblance to secreting glands, but differing from them in having no duct for the conveyance of their secretions, which are reabsorbed or filtered through the tissues, or find an outlet by bursting. 15. Skin—cutis vera, derma, or corium, the innermost of the three structures that go to make up what is commonly termed the skin, and which covers the whole body. 16. Pigment, a black or dark-coloured substance occurring in various parts of the body, and giving colour to the skin of the negro and other dark races. 17. Epithelium, a thin transparent structure covering the whole surface of the body, as well as the walls of the different cavities, and named differently, according to the parts which it covers; as, epidermis, covering the skin; the epithelium of mucous membranes, &c.

Descriptive or Special Anatomy is commonly divided into several branches, according as it regards the bones (*Osteology*); the articulations; the muscles (*Myology*); the blood-vessels and absorbents (*Angiology*); the nervous system (*Neurology*); the organs of sensation, respiration, digestion, &c. (*Splanchnology*).

Osteology.—The number of bones in the human body is variable; but in the adult they are estimated at about 244. They are usually divided into long, flat, and irregular—long, as in the thigh and leg; flat, as in the skull and pelvis; irregular, as in the hands and feet. Bones are covered with a peculiar membrane called the periosteum, which serves to conduct the blood-vessels and nerves. The osseous skeleton is divided into head, trunk, upper and lower extremities. The head comprises the bones of the cranium and those of the face, including three common to both. The bones of the cranium are eight in number—the frontal, in the fore part of the skull; the two parietal, forming a portion of its sides and all its superior part; the occipital, forming its lower and back part; the two temporal, forming the lower part of the sides and part of the base; the sphenoid, in the middle of the base; and the ethmoid, in the middle of the fore part of the base. The bones of the face are fourteen in number—the ossa nasi, which form the arch of the nose; the ossa lacrymalia, at the fore part of the inner edge of the ocular orbits; the malar bones, forming the prominences of the cheeks; the upper maxillary bones, forming the upper jaw, and containing the upper teeth; the ossa palati, situated at the posterior part of the palate, the nose, and the orbits; the vomer, a flat bone forming part of the septum of the nose; the ossa turbinata inferiora; and the lower maxillary bones, forming the lower jaw, and containing the under teeth. There are thirty-two teeth—sixteen in each jaw, viz., four incisors or front teeth, two cuspidati or canine, four bicuspidati, and six molares. The last molar on each side is called the *dens sapientiæ*, or wisdom-tooth, from not appearing till about the age of twenty-one. The os hyoides, or hyoid bone, is placed in the anterior and upper part of the neck, and has no osseous connection with any other bone. The trunk is divided into the spine, thorax, and pelvis. The spine is a pyramidal column, extending from the head to the pelvis, and is composed of twenty-four bones, termed vertebræ. Each vertebra consists of a body of seven processes, and has a foramen, or ring, through which the spinal cord passes. They are divided into three classes—the cervical, including the first seven; the dorsal, consisting of twelve, which are larger than the cerebral, and are distinguished by having their sides and transverse processes depressed for connection with the ribs; and the lumbar, consisting of five, which are larger than any other. The first two cervical vertebræ differ from the others, and are known as the atlas and the axis, or vertebra dentata. There are likewise five so-called false vertebræ, on account of their being separate in early life, but afterwards uniting to form the os sacrum, which constitutes the posterior part of the pelvis. The thorax, which contains the principal organs of circulation and respiration, is the largest of the three great cavities connected with the spine, and is formed by the sternum and costal cartilages in front, the twelve ribs on each side, and the dorsal vertebræ behind. The sternum is a flat narrow bone, situated in the anterior part of the thorax, and connected with the ribs by means of the costal cartilages. The ribs are twenty-four in number, twelve on each side, of which the first seven are termed vertebro-sternal, or true ribs, and are attached to the sternum; three are attached to the costal cartilages, and are called vertebro-costal; and two are termed vertebral or floating ribs, from their anterior extremities being free. The pelvis, or lower cavity of the trunk, consists of four bones—the os sacrum and os coccygis behind, and the two ossa innominata on either side. The os coccygis, which forms the terminal bone of the spine, is sometimes regarded, like the os sacrum, as composed of four false vertebræ, which are at first distinct, but afterwards become united. The ossa innominata are two irregularly-shaped bones, situated one on each side of the pelvis, and consisting of three parts, the ilium, ischium, and pubis, firmly united in the adult, but distinct in the young subject. Each of the two upper extremities is composed of the bones of the arm, the forearm, and the hand, and is united to the trunk by means of the scapula and clavicle, which form the shoulder. The scapula is a flat triangularly-shaped bone, placed upon the upper and back part of the thorax, The clavicle, or collar-bone, is a long bone, something in the form of the italic letter *f*, and situate between the top of the sternum and the acromion process of the scapula. The arm has only one bone, the os humeri, which extends from the scapula to the bones of the forearm. The forearm consists of two bones, the radius and ulna, which are parallel, and play upon each other; thus admitting of freer motion in that part. The radius, so called from its resemblance to the spoke of a wheel, is situate on the outer side of the forearm. Its upper end is small, and forms only a small part of the elbow-joint, while its lower extremity is large, and forms the chief part of the wrist-joint. The ulna is placed at the inner-side of the forearm, and differs from the radius in being larger at the upper than at the lower extremity. The bones of the hand are divided into the carpus, the metacarpus, and phalanges. The bones of the carpus, or wrist, are eight small bones, arranged in two rows, the upper row comprising the scaphoid, semi-lunar, cuneiform, and pisiform—the lower, the trapezium, trapezoid, os magnum, and unciform. The metacarpal bones, or bones of the palm, are five in number, and correspond to the fingers. The phalanges, or bones of the fingers, are fourteen in number, each finger, with the exception of the thumb (which has only two), having three of them. The upper and lower extremities bear a great resemblance to each other in the nature and form of their bones. Like the upper, each of the lower extremities consists of three distinct parts—the thigh, leg, and foot. The thigh is composed of a single bone, the os femur, which is the longest and largest in the body. The upper part forms a round head, which is inserted into a deep cup-like cavity of the os innominatum, called the acetabulum: the lower terminates in two protuberances, known as the inner and outer condyles, separated posteriorly by a deep fossa, called the inter-condyloid. The leg consists of three bones—the patella, tibia, and fibula. The patella, or knee-pan, is a small, flat, triangular bone, of a spongy texture, situated at the anterior part of the knee-joint, between the femur and the tibia. The tibia and fibula in the leg resemble the radius and ulna in the forearm; the tibia is, after the femur, the largest bone of the body; it is situated at the anterior and inner side of the leg, articulating with the femur above and the astragalus below. The fibula is considerably smaller than the tibia. Its upper extremity is small, and placed below the level of the knee-joint, but the lower extremity projects below the tibia, and forms the outer ankle. The foot, like the hand, is composed of three classes of bones—the tarsus, the metatarsus, and the phalanges. The tarsus is composed of seven bones—the os calcis, astralagus, cuboid, scaphoid, and three cuneiform. The metatarsal bones are long small bones, five in number, connected at the one extremity with the tarsal, at the other with the phalangeal bones: these last go to form the toes, each of which has three, except the great toe, which has only two.

Articulations.—The different bones of the skeleton are connected together in various ways, and such connections are termed articulations. They are of various kinds, but are usually divided into immovable, movable, and mixed. Immovable articulations exist where flat and broad bones are united to inclose important organs, as in the cranium and pelvis. In some parts the edges indent or interlock each other; in others they are brought into close contact, or are united together by a thin layer of cartilage. The movable articulations are of various kinds, according to the kind of motion required. In such cases, the bony surfaces brought into contact are covered with cartilage, bound together by ligaments, and lined by synovial membrane. Mixed articulation prevails where only a slight degree of motion is required, combined with great strength, as in the vertebræ.

Myology.—The following are the principal muscles of the human body: The *occipito-frontalis* is spread over the whole of one side of the vertex of the skull, from the occiput to the eyebrow. It is composed of a broad musculo-fibrous layer, and consists of two slips of muscle. Its action is to raise the eyebrows and the skin over the root of the nose. The *levitor labii superioris* acts as the elevator of the upper lip. The *orbicularis oris* is a muscle of elliptic form, composed of concentric fibres, and situated round the opening of the mouth. In action it is antagonistic to all those muscles which converge to the lips from the various portions of the face. The *deltoid* has been so named from its resemblance to the Greek letter Δ reversed. It is a triangular thick muscle, which surrounds the shoulder-joint. Its action is to raise the arm from the side, bringing it at right angles with the body. The *pectoralis major* is a thick triangular muscle springing from the anterior surface of the clavical. In its action it will singly draw the arm across the front of the chest, and, when assisted by the *teres major* and the *latissimus dorsi*, will depress the arm, previously raised by the *deltoid*, to the side of the chest. The *linea alba* is a cord extending along the middle line of the abdomen. It runs between the inner borders of the *recti* muscles, and has many appertures for the passage of nerves and vessels. In common with the other abdominal muscles, the *linea alba* acts as a compressor of the viscera in the cavity of the abdomen. The *pyramidalis* acts like the other abdominal muscles. The longest muscle in the human body is the *sartorius*, or tailor's muscle, a flat and narrow band arising from the anterior superior spinous process of the ilium, passing obliquely across the upper part of the front of the thigh, and ending in a tendon, which afterwards expands into a wide aponeurosis inserted in the shaft of the tibia near the crest. "The relations of this muscle to the femoral artery should be carefully examined, as its inner border forms the chief guide in tying the artery. In the upper third of the thigh it forms, with the abductor longus, the side of a triangular space—Scarpa's triangle—the base of which turned upwards is formed by Poupard's ligament; the femoral artery passes perpendicularly through the centre of this space, from its base to its apex. In the middle third of the thigh the femoral artery lies first along the inner border, and then beneath the *sartorius*."—(Gray's *Anatomy, Descriptive and Surgical*.) The *rectus femoris* is a muscle of fusiform shape, arising by two round tendons from the inferior spinous process of the ilium, as well as from the upper lip of the acetabulum, and is inserted in the upper border of the knee-cap. It's action is to assist the *iliacus* and *psoas* muscles in supporting the trunk and pelvis upon the thigh-bone. The *anterior annular ligament* of the ankle serves to bind down the extensor tendons which descend upon the posterior portion of the fibula and tibia. The *latissimus dorsi* is a broad muscle which covers the lumbar and lower half of the dorsal regions. It arises from the lumbral, sacral, and inferior gorsal vertebræ, and is inserted into the humerus. The *gluteus maximus*, the outermost muscle of this region of the body, is a broad fleshy mass of quadrilateral form, which contributes greatly to the characteristic power of the human being to support the body in a constantly erect posture. The *biceps* of the thigh is a very long muscle, the action of which is to rotate the leg slightly outwards when the knee is semi-fixed. The *gastrocnemius* muscle is the most superficial of the posterior tibio-fibular region. It arises from the upper portion of the two condyles of the femur, and by means of the *tendon Achillis* is inserted into the lower portion of the tuberosity of the *os calcis*.

Angiology.—The aorto is the large vessel which arises from the left ventricle of the heart, and thence conveys the artenal blood by numerous branches to the various parts of the body. It is an elastic tube about three inches in circumference at first, but afterwards becomes considerably narrower. In the first part of its course, it is nearly vertical; it then forms an arch, and, curving from right to left, and from before backwards, it descends through the diaphragm out the abdominal cavity. The aorta gives off numerous branches, which may be divided into two sets—those which supply the viscera, and those which are distributed to the walls of the abdomen; the former comprising the cœliac artery (which shortly divides into the gastric, epatic and splenic arteries), the superior mesenteric, the inferior mesenteric, the capsular, the renal and the spermatic arteries; the latter, the phrenic, lumbar, and middle sacral arteries. The veins which return the blood from the capillaries to the heart are of two kinds—the pulmonary, conveying arterial blood from the lungs to the left auricle of the heart, and the systemic, carrying venous blood from all parts of the system back to the right auricle of the heart. The pulmonary veins are four in number, two for each lung, and differ from other veins in being destitute of valves. The systemic veins are usually arranged into three groups, according to their mode of termination in the heart:—1, Those of the head, neck, thorax, and upper extremities, which terminate in the superior vena cava; 2, those of the abdomen, pelvis, and lower extremities which terminate in the inferior vena cava; and 3, the cardiac veins, returning the blood from the substance of the heart, and opening directly into the right auricle. The veins, in their general form and distribution, correspond to the arteries. The vena cava superior is a short trunk formed by the junction of the two venæ innominatæ, and terminating in the upper parts of the right auricle. The vena cava inferior is formed by the junction of the two common iliac veins between the fourth and fifth lumbar, vertebræ and terminates in the lower and back part of the right auricle. The capillaries (from *cappilus*, a hair) are minute vessels pervading every part of the body, and uniting the extreme points of the arteries with those of the veins. Their diameter varies in different parts, but is usually about $\frac{1}{3000}$th part of an inch. (*See* CIRCULATION OF THE BLOOD, LACTEALS and LYMPHATICS.)

Neurology.—The Nervous System consists of two parts, known as the cerebro-spinal and the sympathetic or ganglionic systems. The former includes the brain and spinal cord, with the nerves proceeding from them, and is regarded as the nervous system of animal life; the latter consists of a double chain of ganglia, running along the spinal column, whose functions seem to be less directly connected with the mind, and chiefly bearing upon the animal life. The cerebro-spinal system is divided into the encephalon, or portion contained within the cranium, and the spinal cord, inclosed within the vertebral canal. The encephalon comprises the cerebrum, the cerebellum, the pons Varolii, and the medulla oblongata, and is covered with three membranes, called the dura mater (or outermost), the arachnoid membrane, and the pia mater. The substance of the encephalon is of two kinds—a cineritious or greyish substance, called also corticle, from forming the outer part of the cerebrum and cerebellum; and a white or medullary matter, forming the inner substance of the cerebrum and cerebellum, but the outer of the medulla oblongata and pons Varolii. The cerebrum, or brain proper, forms by far the largest portion of the encephalic mass. Its upper surface is divided into a right and left hemisphere, by a longitudinal fissure lodging the falx cerebri. The under surface of each hemisphere is marked off into three lobes, called the anterior, middle, and posterior. The entire surface of each hemisphere presents a number of convoluted eminences, separated from each other by depressions of various depths. The cerebellum, or little brain, is situate beneath the hinder part of the cerebrum, from which it is separated by the tentorium cerebelli. It is likewise divided into two lateral hemispheres; but its surface is not convoluted, but laminated. It is connected with the rest of the encephalic masses by means of connecting-bands, called crura or peduncles, two of which ascend to the cerebrum, two descend to the medulla oblongata, and two unite in front to form the pons Varolii. This last occupies a central position on the under surface of the encephalon, and constitutes the bond of union between the other parts, being connected above by crura from the cerebrum, at each side by crura from the cerebellum, and being in contact below with the medulla oblongata. This last extends from the lower border of the pons Varolii to the upper part of the spinal cord. It is pyramidal in form, with its broad extremity directed upwards, and measures about an inch and a quarter in length. By means of two fissures, it is divided into two lateral and symmetrical halves. The spinal cord is situate within the vertebral canal, and extends from the foramen magnum of the occipital bone to the first or second lumbar vertebræ, where it terminates in the cauda equina, an aggregation of nervous cords occupying the remainder of the canal. The spinal cord, like the encephalon, is inclosed by the three membranes—the dura mater, arachnoid, and pia mater. It it composed of white and grey matter; the former external, the latter internal. The grey substance is found, on making a section, to be arranged in a crescental shape in each hemisphere of the cord, the posterior corners being much longer than the anterior. From the spinal cord spring thirty-one pairs of spinal nerves, corresponding to the number of true and false vertebræ, between which they issue, except that there are eight pairs of cervical nerves and one coccygeal. Each spinal nerve arises by two roots, —an anterior, or motor, and a posterior, or sensitive. These approach one another, and, with few exceptions, unite in the corresponding inter-vertebral foramen into a single cord, which almost immediately divides into two branches, one of which proceeds to the muscles, &c., of the back, the other to the anterior parts of the body. Besides the spinal nerves, there are nine pairs of nerves that issue from the encephalon to different parts of the head and face. They are connected with the organs of seeing, hearing, taste, smell, &c.; and are hence named optic, audatory, olfactory, &c. They are also distinguished numerically, as first, second, third, &c., according to the part of the brain from which they spring. The sympathetic, or ganglionic nervous system, is composed of a series of ganglia, or nervous centres, extending along the spinal column from the base of the skull to the coccyx, connected with each other by filaments, and also communicating in various parts with the cerebro-spinal system. They are regarded as the nerves of organic life, and principally supply the various viscera and blood vessels.

Splanchnology.—Regarding the anatomy of the various organs of SENSATION, RESPIRATION, DIGESTION, &c., we must refer to the accouuts given under their proper names, in other parts of this work.

History.—Some knowledge of the internal structure of the human body was doubtless obtained at a very early period. The ancient Egyptians are said to have acquired great anatomical skill from their practice of embalming, and Homer displays a considerable amount of knowledge of the human body in his description of wounds, in the "Iliad." Hippocrates, who flourished about 400 years B.C., is regarded as the first author who treated anatomy as a science. Erasistratus, and Herophilus of Alexandria, are considered as the first that dissected and described the human body, nearly 300 years B.C. Galen, however (B. 131 A.D.), is the author of antiquity that displays the most intimate knowledge of the human body; and even he evidently obtained a great part of his knowledge from dissections of apes and other animals, there being a law in Rome which forbade the use of dead bodies. During the dark ages, anatomy, like the other sciences, made little progress. The interest in anatomy began to revive about the 13th century, and, in the beginning of the 14th, Mundinus dissected and demonstrated the different parts of the human body, at the University of Bologna, and published a work which formed the text-book in Italy for nearly 200 years. During the next 200 years, the interest in anatomy continued to increase, and, within that period, there are several respectable names in connection with it; as Gabriel de Zerbio, Achillini, Berenger, and Massa. The errors of Galen, however, still prevailed till the time of Vesalius, who flourished about the middle of the 16th century, and boldly, by dissections of the human body, pointed out the errors into which he had fallen. He is regarded as the father of modern anatomy. His great work, *De Corporis Humani Fabrica*, was published before he was twenty-eight years of age. He gave a great impulse to human dissection; and, among his contemporaries, or immediate successors, were Fallopius, Eustachius, Varoli, and Fabricius. In the 17th century the progress of anatomy was rapid. In 1619 Harvey's great discovery of the circulation of the blood was announced. Asellius, in 1627, gave out his discovery of the lacteals; and in 1651 Rudbeck discovered the lymphatics. Among the other distinguished anatomists of this century were Bartholin, Pecquet, Jolyffe, Wharton, Swammerdam, Willis, Malpighi, and Ruysch. In the 18th century we have many eminent names. In Italy, which still retained a first place, were Valsalva, Santorini, and Morgagni; in France, Winslow, Vicq d'Azyr, and Bichat (the founder of General Anatomy); in Germany, Haller, Meckel, Zinn, and Soemmerring; in Holland, Boerhaave, Albinus, Camper, and Bonn; and in England, Cheselden, the two Hunters, Charles Bell, and the Monroes of Edinburgh. The present century has been specially characterised by the great advance made in minute or microscopic anatomy.

Comparative Anatomy.—The differences in the structure of various animals was first treated systematically as a distinct science by Cuvier. Other great names connected with this subject are Blumenbach, Tiedemann, Geoffrey, St. Helaire, Carus, Oken, Owen, Huxley, and Darwin.

Practical Anatomy includes dissection and the making of preparations by dividing parts or organs so that their respective forms and positions may be clearly shown. The bones are cleared of all adhesions, bleached, and connected by wires in natural order. Vessels are injected with a mixture of linseed oil and turpentine and certain metallic compounds in due proportion. Anatomical preparations are either dried and varnished or preserved in spirits.

ANCHOVY, *an-tcho've*, or *an'-cho-ve* (Fr., *anchois*), a genus of abdominal malacopterygious fishes of the herring family. With the exception of the common anchovy, they all inhabit the tropical seas of America and India. The common anchovy (*Engraulis Enchrasicholus*, so named from the bitter taste of its head), is found in the Atlantic, along the shores of France and Portugal. It is sometimes taken off the coasts of Holland and England; but is abundant in the Mediterranean, where, off the island of Gorgona, to the west of Leghorn, it is very plentiful. The months of May, June, and July are the periods when they quit the deep seas and visit the shores of the Mediterranean, which they enter in immense shoals by the Straits of Gibraltar. The Romans compounded from them a favourite sauce, which they termed *garum*. In Modern times, the anchovy is also regarded as an appetizing morsel in the form of pastes, &c. Colour, the bluish-brown on the back, and silvery white on the belly; the anal fin short, and the dorsal placed immediately above the ventral. The length of the anchovy is about three inches. The well-known Indian condiment, "red-fish," is made from a variety of the anchovy, *E. Brownii*, found at the mouth of the Ganges, and in the Straits of Malacca.

ANCHOVY PEAR. (*See* GRIAS.)

ANCHUSA, *an-choo'-sa*, a genus of plants belonging to the natural order *Boraginaceæ*. The calyx is divided into five segments; the corolla is funnel-shaped, the mouth of the tube being closed with five scales; the stamens are five in number; the stigma is obtuse; and the achænia, which are ovate, are surounded by a thick ring. The species are herbaceous plants growing in temperate climates, and are all characterized by short stiff hairs on the leaves and stems. Two are inhabitants of Great Britain; namely, *A. officinalis* (the common alkanet or bugloss) and *A. sempervivens*. The roots of the former, when boiled, yield a demulcent drink, which was once much used as a medicine. Both plants have spikes of blue flowers, very similar to those of the forget-me-not. The most important species is *A. tinctoria*, a native of the Levant and of the southern parts of Europe. It is cultivated for its root, which contains a resinous red colouring matter, and is much used in the arts. (*See* ALKANET ROOT.) *A. paniculata* and some other species are grown as ornamental garden plants.

ANCILLA, OR ANCILLARIA, *an-sil-lai'-ri-a*, a term given by Lamarck to a genus of mollusca. They are somewhat numerous, principally found in tropical climates. Some of them are furnished with a small tooth, which is placed at the end of a groove crossing the front of the shell. The most common species is the ivory-shell; this and some others are distinguished from the genus in general, by having the front of its axis deeply pierced. The shells are usually very smooth, as if polished.

ANCONEUS, *an-ko'-ne-us* (Gr., *agkon*, the elbow), a small triangular muscle, situated immediately beneath and behind the elbow-joint. It is connected with the humerus above, and the ulna below, and assists in extending the fore-arm.

ANCYLUS, *an-si'-lus* a mollusc, commonly known as the fresh-water limpet. It is common in stagnant water and rivulets in Europe, America, and the West Indies, adhering to stones and plants. It is closely allied to the pond-snail, differing principally in the conical form of the body and shell. A cavity in the middle of the back serves for the purposes of respiration, and an aperture closed by a valve opens in the middle of left side.

ANDA, *an'-da*, a genus of plants belonging to the natural order *Euphorbiaceæ*. The species *A brasiliensis* is a tree which grows in Brazil, having large yellow flowers, and producing fruit about the size of an orange, but of an angular form. Each fruit contains two roundish seeds, resembling small chestnuts. These seeds, called *Purga dos Paulistas*, yield a very purgative oil, used medicinally in Brazil, the ordinary dose being twenty drops. These seeds are also used for the same purpose as the oil. The bark, when thrown into ponds, is said to stupify fish; and this part of the tree, roasted, forms a favourite remedy for diarrhœa brought on by cold.

ANDIRA, *an-di'-ra*, a genus of plants belonging to the natural order *Leguminosæ*, sub-order *Papilionaceæ*, characterized by a one-celled one-seeded pod, almost orbicular. The species *A. inermis* is a native of the West Indies, and is commonly known as the Cabbage-bark tree. It is a tall tree, bearing reddish-lilac flowers. The bark, called either cabbage-bark or worm-bark in commerce, was formerly much used medicinally, but has recently been discarded from the Pharmacopœia of Great Britain. It possesses cathartic, emetic, and narcotic properties; but in large doses it is poisonous. The species *A. retusa*, a native of Surinam, yields a bark with similar properties, which is commonly known as Surinam bark.

ANDRÆACEÆ, *an-dre-ai'-se-e*, Split mosses, a family of terminal-fruited mosses, characterized especially by the peculiar mode of splitting of the fruit, or, more correctly speaking, the *sporangium*. This urn-shaped capsule divides perpendicularly, when ripe, into four or eight valves, which remain attached together at their upper and lower points. The few British species which constitute the genus *Andræa* are natives of rocky and usually mountainous districts.

ANDRENIDÆ. (*See* BEES.)

ANDRŒCIUM, *an-dre'-shi-um* (Gr., *aner*, a male, *oikion*, habitation), a term applied to the stamens or male organs of a flowering plant, taken collectively.

ANDROGYNOUS, *an-droj'-i-nus*, a term signifying male-female, sometimes applied to that kind of inflorescence which exhibits distinct male (staminal) and female (pistillate) flowers. In zoology, the term applied to animals which possess a distinct male and female generative system in the same individual. (*See* HERMAPHRODITE and REPRODUCTION.)

ANDROMEDA, *an-drom'-e-da*, in Astronomy, a constellation named by the Greeks after the mythical daughter of Cepheus and Cassiopeia. This constellation is composed of fifty-nine stars. A line drawn through the brightest star of the five forming the constellation Cassiopeia and the Pole-star passes through a star of the first magnitude, named Alpherat, in the head of Andromeda. This constellation is represented in the celestial planisphere by the figure of a chained woman.

ANDROPHORE, *an'-dro-for* (Gr., *aner*, male, *phoros*, brought into), a name given to a tube or column formed by the union of the stamens by their filaments, as in the flower of the mallow.

ANDROPOGON, *an'-dro-po-gon*, (Gr., *aner*, man, *pogon*, beard), a genus of grasses, or natural order *Graminaceæ*. A tufted root thought to resemble a man's beard is one of the characters of the genus; hence its botanical name. Many species are remarkable for their fragrance, which is due to the presence of volatile oils, some of which are used in perfumery and medicine. *A. Iwarancusa* is supposed by some to have furnished the precious spikenard oil of Scripture; and *A. calamus aromaticus* has been pointed to as being probably the plant termed the sweet calamus and sweet cane. The oil is known in India as *roshé* or *rosé* oil, and, in England, as Turkish essence, or oil of geranium, and oil of ginger-grass, is reputed to be the produce of the latter species; but, in all probability, it is derived from several Indian andropogons. This oil is employed by the Turks to adulterate otto of roses, and is considered by some to be identical with the grass-oil of Nemaur. The species *A. citratum*, Indian lemon-grass, is much employed in perfumery, under the name of oil of verbena, from its odour resembling that of the sweet verbena, or lemon-plant. The leaves of the Indian lemon-grass have been used as a substitute for tea, and the centre of the stem is employed for flavouring curries. *A. muricatus*, vittievayr or cuscus, also yields a fragrant oil, which is much used medicinally in India, and there known as kuskus oil. Its root, which is imported into this country for scenting baskets and other articles, has been employed medicinally as a gentle stimulant and antispasmodic.

ANDROSÆMUM, *an-dro-se'-mum*, a genus of plants belonging to the natural order *Hypericaceæ*. The species *A. officinale* has tonic and astringent properties, which render it useful in medicine.

ANDROUS, *an'-drous*, a term signifying a stamen, which is affixed to the Greek numerals, in order to form names used in describing flowers, when it it desirable to indicate the actual number of stamens they contain. Thus, the presence of only one stamen makes a *monandrous* flower, as in the Hippuris; if two male organs are present, the flower is *diandrous*; *triandrous*, means three stamens; *tetrandrous*, four; *pentandrous*, five; *hexandrous*, six; *heptandrous*, seven; *octandrous*, eight; *enneandrous*, nine; *decandrous*, ten; *dodecandrous*, twelve; *icosandrous*, twenty; *polyandrous*, numerous stamens. In the old Linnæan system of classification, many of the classes were determined by the number of stamens in the flower, and these terms were in constant use. The natural system has, however, quite superseded that arrangement; but the terms have been retained in descriptive botany, on account of their expressiveness.

ANELECTRIC, *an-e-lek'-trik*, a term sometimes applied to a body in which, under ordinary circumstances, electricity cannot be excited by friction. It is synonymous with the more familiar word *non-electric*. Anelectrics have the power of transmitting or conducting electricity. The best conductors, or the most perfect anelectrics, are metallic bodies, charcoal, and saline fluids. (*See* ELECTRICITY.)

ANEMIDICTYON, *an-e-mi-dik'-ti-on* (Gr., *aneimon*, naked; *diktyon*, a net), an ornamental species of ferns, succeeding well in open loamy soil.

ANEMIOPSIS, *an-em-i-op'-sis* (Gr., *aneimon*, naked; *opsis*, appearance), so named in allusion to the appearance of the inflorescence. A genus of plants growing in marshes and pools of water in North India, North America, and China.

ANIMALCULES, *an-i-mal'-ku-lees* (Lat., *animalculum*, a little animal). This is a general term for animals so exceedingly minute that they cannot be studied without the aid of the microscope; such as the species of *Infusoria* and *Rotatoria*. (*See* INFUSORIA, PROTOZOA, ROTATORIA.)

ANIONS, *an'-i-ons* (Gr., *ana*, upward, *ion*, going), a term introduced by Faraday to distinguish the elements which go to the *anode*, or positive pole, in decomposing chemical compounds by the electric current. (*See* ELECTROLYSIS, CATHIONS.)

ANISE, *an'-eez* (Gr., *anison*, Lat., *anisum*), an umbelliferous plant, cultivated in Asia Minor, Egypt, Malta, Spain, and Germany, for the sake of its fruit, called aniseed, which is extensively used for flavouring liqueurs and confections, and medicinally as a carminative. The botanical name of the plant is *Pimpinella Anisum*. Star or Chinese aniseed is the fruit of the *Illicium anisatum*, a small tree in the natural order *Magnoliaceæ*. It has a starlike form—hence its name, and a flavour similar to that of the common aniseed. This is imported into Europe from China and Singapore. Oil of aniseed is obtained by distilling the fruit, and even the stems and leaves, of the common anise. For this, a similar product, yielded by the star aniseed, is frequently substituted. The true oil and its substitute have the aromatic properties of the fruits, and are employed for the same purposes. The anise of the New Testament is the Dill, the name of which is derived from an old Norse word, meaning to soothe.

ANISOMERUS, *an-i-som'-e-rus* (Gr. *ansios*, unequal, *meros*, a part), a term applied to a symmetrical flower, in which the number of parts in every whorl of organs is not the same, as in the flower of the *sedum*, which has five sepals, petals, and carpels, but ten stamens. (*See* ISOMEROUS, FLOWER.)

ANISOSTEMONOUS, *an'-i-sos-tem'-o-nus* (Gr., *anisos*, unequal, *stemon*, a stamen), a term applied to a flower in which the stamens are not equal in number to the sepals or petals. (*See* ISOSTEMONOUS.)

ANNELIDA, *an-nel'-i-da* (Lat., *annulus*, a ring), a class of animals of the sub-kingdom, *Annulosa*, the worm species, first proposed for distinct classification by Cuvier, who attached such importance to the fact of their possessing red blood that he placed them at the head of the articulate series, above the crustaceas, the arachnidas, and the insects. It is, however, generally agreed that the annelida represent but the larval condition of insects, and can hardly be regarded as higher in organization than the perfect insect. The name of the class is derived from *annulus*, a ring; because the animals arranged under this division always have their bodies formed of a great number of small rings, as in the earth-worm. (*See* EARTH-WORM.) For the most part, the annelida are oviparous. In their mode of life there is little variety; some live in fresh, others in salt water; some, like the hair-worm (*Gordius*), are amphibious. The body is divided into numerous segments, marked by transverse lines, and generally furnished with a series of bristly appendages, which serve as legs, are usually sharp, and sometimes barbed, serving not only to attach the animals to soft substances, and to hold firmly on to rocks and other solid bodies, but to aid their movements through the water. They are all hermaphrodite, but most require mutual fecundation. They feed in general upon other animals, and some (as the leech) live by sucking blood. Some of them bore and burrow in sand, mud, and earth, and even perforate rocks, shells, and stones; and their influence in disintegrating coral, limestone, and chalk is considerable.

ANNUAL, *an'-nu-al* (Lat., *annus*, a year), a plant which passes through all its successive stages of development in a single year. Such a plant produces flowers and fruit only once, and perishes when its fruit has become ripe. A plant which springs from the seed one year, but which does not flower until the next year, is called a *biennial;* and a plant which lives for several years a *perennial*. The duration of the life of a plant is greatly affected by accidental circumstances; and an annual is frequently converted into a biennial, and occasionally into a perennial. Some plants which are annual in one climate are perennial in another. The annuals cultivated in our gardens are very numerous, and many of them produce lovely flowers.

ANNULAR CELLS AND VESSELS, *an'-nu-lar* (Lat., *annulus*, a ring). The various parts of a plant are made up of little membranous sacs and tubes called *cells* and *vessels*. These are often strengthened by delicate threads or bands called fibres, formed by secondary deposits on the inner surfaces of the primary membranes. When these fibres exist as rings or hoops, the cells and vessels containing them are said to be *annular*.

ANNULAR ECLIPSE, an eclipse of the sun, in which the moon is wholly projected on the sun's disc, but, having a less apparent diameter, or ring of light from the outer parts of the sun's disc remains visible. (*See* ECLIPSE.)

ANNULATA SEDENTARIA, *an'-nu-lai'-ta sed'-en-tair'-i-a*, a carnivorous tribe of worm-like animals, inhabiting a tube-shaped shell, which they never quit. They are usually found adhering to marine substances.

ANNULATE, *an'-nu-lait* (Lat., *annulus*, a ring), a term applied to those ferns which have ringed sporangia (cases containing spores). The annulus or ring surrounding each sporangium is elastic, and its pressure causes the organ to burst when ripe, and release the spores. Those ferns which have sporangia not encircled by rings are said to be *exannulate*.

ANNULATED ROOT, *an-nu-lai'-ted* (Lat., *annulus*, a ring), a root having a number of ring-like expansions, so as to present the appearance of a string of thick rings, as in the ipecacuanha.

ANOBIUM. (*See* DEATH-WATCH.)

ANODE, *an-ode'* (Gr., *ana*, upwards, *odos*, a way), a term introduced by Faraday to designate the positive pole of any electrical arrangement for decomposing a chemical compound. The anode, or positive pole, is the surface by which the electric current enters the body undergoing decomposition. (*See* ELECTROLYSIS CATHODE.)

ANODYNE, *an'-o-dine* (Gr., *a*, without, *odune*, pain), a medicine which allays pain. The term is usually applied only to a medicine which acts upon the nervous system, so as to decrease sensibility and induce sleep, or a state of partial unconsciousness. The most important anodynes are preparations of opium.

ANOLIS, OR ANOLIUS, *a-no'-li-us*, a reptile peculiar to America, supplying in many respects the place which the chameleon occupies in the old world. The colour of the skin, especially that about its loose baggy throat, assumes an endless succession of ever-varying hues, as the animal is disturbed by love or anger. The anolis, however, is more slenderly built than the chameleon, and more active in its movements. It varies from seven or eight inches to a foot in length, and is extremely tame and harmless. Its food consists of flies and other small insects. The head is long, straight, and flattened; the body and tail slender; and both are covered with small round scales, which give the skin the appearance of fine shagreen.

ANOMALISTIC YEAR, *a-nom'-a-lis-tik*, (Gr., *anomalos*, irregular), in Astronomy, the time which the earth takes in passing through its orbit from its perihelion, at which it is at its least distance from the sun, until it again arrives at that point. Under the disturbing influences of the planets, the perihelion of the earth advances 11·8" yearly, following the direction of the earth's path. The anomalistic year is 25 minutes longer than a solar year, and 4 min. 39 sec. longer than a sidereal year.

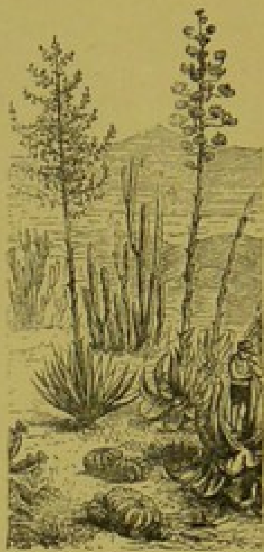
ANOMALOUS, *a-nom'-a-lus* (Gr., *a*, without, *nomos*, a rule), this term is applied to all parts of a plant when they have very irregular or unusual forms.

ANOMALY, in Astronomy, the angle measured at the sun between a planet in any point of its orbit at the last perihelion. It is so called because it was in it that the full irregularities of planetary motion were discovered.

ANOMOPTERIS, *an-o-mop'-te-ris* (Gr., *anomos*, without rule, *pteris*, fern). This term is applied to a genus of fossil ferns peculiar to the new red sandstone. The plants differ from all recent and fossil ferns; hence the generic name, which signifies "anomalous fern."

ANONA, *a-no'-na*, the custard-apple, a genus of plants belonging to the natural order, *Anon-*

AURORA BOREALIS.



AGAVES.

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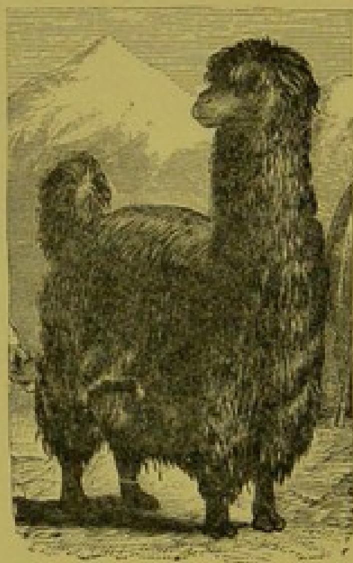
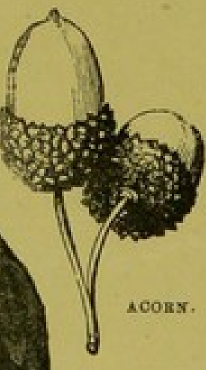


ALPACA.

ADJUTANT BIRD.



ACORN.

ADAMANT

ACORN GERMINATING.

AYE-AYE.

aceæ, and composed of small trees and shrubs growing in the West Indies and South America, where they are cultivated for the sake of their delicious fruits. The most important species are *A. squamosa* and *A. muricata*. The first, commonly known as the sweet sop, is found in all the West Indian islands. The fruit is covered with greenish scales, and has the appearance of a young pine-cone. The edible portion consists of a thick, sweet, and luscious pulp. *A. muricata*, the sour sop, which is also a native of the West Indies, is a picturesque small tree, bearing a yellowish-green fruit, weighing from 1 lb. to 3 lbs., and covered with weak prickles. Its pulp is perfectly white, and has a most agreeable acid taste. *A. reticulata* yields the netted custard-apple, a large, dark-brown fruit, filled with yellowish or reddish pulp of about the consistence of custard. *A. cherimolia* is cultivated in Peru, on account of the excellence of its fruit, which is called the cherimolia. Two other important species have been described—*A. sylvatica* (the *Araticu do Mato* of Brazil) and *A. palustris*, both of which furnish light and handsome wood, used for turnery.

ANONACEÆ, *an-o-nai'-se-e*, a natural order of dicotyledonous plants, of which the type is the genus *Anona*. They are trees or shrubs, with leaves alternate, simple, and without stipules. In the flower we find a calyx of three sepals, and a corolla of six leathery petals, arranged in two whorls. The carpels are usually numerous, distinct or united; the styles short, the stigmas simple, and the ovules inverted. The fruit is composed of a number of dry or succulent carpels, sometimes distinct, but oftener united, so as to form a fleshy mass. The plants of this order are almost entirely confined to the tropical regions of Asia, Africa, and America, none being found in Europe. They are generally aromatic and fragrant in all their parts, and some are very useful. There are about 300 known species, some of which are employed medicinally. The dry fruit of one species, *Xylopia aromatica*, was formerly imported into Europe as Guinea pepper. (*See* ANONA, CÆLOCLINE, DUGUETIA, XYLOPIA.)

ANOPLOTHERIUM, *an'-o-plo-the'-ri-um* (Gr., *a*, without, *oplon*, weapon, *therion*, beast), a genus of extinct quadrupeds, established by Cuvier from bones found in the gypsum strata of the upper Eocene formation near Paris. Several species have been determined, the smallest having been little larger than a guinea-pig, and the largest about the size of a small ass. From the situations in which their remains have been discovered, these ancient inhabitants of our globe appear to have lived in herds in swamps and marshes. Some had slender legs and feet, but others were firmly built and heavy. They had but two toes, as in the ruminants, and were the earliest bi-hoofed animals known to have existed on the earth; but in some specimens there are smaller supplemental toes. In some the tail was short and thick, and was probably made use of in swimming; in others it was short and slender. The dentition appears to have been very peculiar, each jaw having had six incisors, on each side of which was a small canine, and behind these, without leaving any interval, seven molars, resembling those of the rhinoceros. The common anoplothere (*A. commune*) has been taken as the type of a small natural family—the *Anoplotheridæ*, which appear to form a connecting link between the pachyderms, or thick-skinned mammalia, and the ruminants. Cuvier, in describing this typical species, showed that in one respect it stood between the rhinoceros and horse, and in another between the hippopotamus and camel. The name was given to the genus from the fact that all the species seem to have been destitute of organs of defence, as tusks, claws, or horns.

ANOPLURA, *an-o-plu'-ra*, a family of insects, in which are comprehended the *Aptera* of Linnæus and the many varieties of *Pediculus* or louse (*see* PEDICULUS), as well as the parasitic insects of other writers. About 500 different forms of *Anoplura*, all of them parasitic, have been described.

ANORTHITE, *an'-orth-ite* (Gr., *a*, without, *orthos*, right), a variety of felspar, without right angles in its crystals, composed of silica, alumina, magnesia, lime, and oxide of iron.

ANT, *ant* (Lat., *Formica*), a genus of hymenopterous insects, which from the very earliest period of the world's history have attracted attention on account of their social and industrious habits, their love of order and subordination, and unremitting economy. They are distinguished from other *Hymenoptera* by their habit of residing underground in numerous societies, and by the existence of *neuters* among them, by which class the labours of the community are chiefly performed. Although so small, their muscular strength is extraordinary, and they will carry loads at least ten times their own weight, displaying meanwhile considerable activity. They have triangular heads; the antennæ have joints; the jaws strong; the ligula, or lower lip, small, rounded, or spoon-like; the thorax compressed at the sides; the abdomen nearly oval, the pedicle which joins it to the thorax forming in some kinds a single and in some a double scale or knot. A community of ants, whatever the species may be, consists of males, which have always four wings; of females, much larger in size than the males, which only possess wings during the pairing season; and of a sort of barren females, which have been variously termed neuters, workers, or nurse-ants, and which, so far as is known, have never been observed to have wings in any stage of their existence. The nests of ants are differently constructed by the different species; all, however, are very curiously and regularly arranged. If an ant-hill be examined any time after midsummer up to the close of autumn, there may be seen mixed with the wingless workers a number of males and females furnished with white glistening wings. These are not allowed to move without a guard of workers to prevent them leaving the boundaries; and, if one straggles away unawares, it is for the most part dragged back by the vigilant sentinels, three or four of whom may in such cases be seen hauling along a winged deserter by the wings and limbs. The actual pairing does not seem to take place within the ant-hills; and scouts have been observed posted all around ready to discover and carry back to the colony as many fertile females as they could meet with. It is probable that, soon after pairing, the males die, as do the males of bees and other insects; for, as the workers never bring any of tnem back nor take any notice of them after leaving the ant-hill, they must perish, being entirely defenceless, and destitute of a sting and of mandibles to provide for their sustenance. The eggs of ants are so small as to be scarcely visible to the naked eye. When laid they are not glued to any fixed place, but are dropped at random by the mother in her progress through the nest, and carefully collected by the workers, several of whom sedulously attend her during her period of laying. The collected eggs are taken to the various apartments of the nest adapted for the purpose, and there left for hatching. Heat being indispensable, the eggs are placed carefully during the day near the surface of the ant-hill, but so sheltered from the direct influence of the sun, as to prevent the too rapid evaporation of their moisture. As night approaches, the experienced insects to whom the care of the precious ova is entrusted, remove the eggs to warmer quarters, to prevent the escape of the heat they naturally possess. Nor does the care of these tender nurses cease when the little ants come into life. At night they are carefully stowed away in the innermost chambers of the nest, every aperture being closed to prevent the ingress of cold air. But as soon as the rays of the morning sun fall upon the surface of the nest, the workers busily commence carrying their infants to the upper chambers, where, close under the roof, they may enjoy the genial warmth. Not unfrequently, they even place them for a time on the outside of the nest, exposed to the direct rays of the sun. During their grubhood, the little creatures are fed by the nurses, or by the mother herself, by a liquid disgorged from the stomach. When the grubs are full grown, they spin cocoons of a membranous texture, and of a brownish-white colour, in appearance not unlike barleycorns, for which, indeed, they were mistaken by early observers. Hence, doubtless, arose the belief that the insect laid up a store of grain in the summer season, to serve for its support in the winter. European ants are carnivorous in their habits, and do not, as has been frequently said, lay up stores of corn for the winter, for they are in a state of torpidity during the winter months, and require no food. In India, however, ants have been known to lay up large stores of millet-seed; and it is possible that other species may have the same habit. The vegetable substance which ants appear chiefly to use as food, is sugar, and to this, wherever it is to be found, they seem to be guided by a very acute sense of smell. *Honey-dew*, the saccharine excretion of the *aphides*, is a favourite food of many species. Not only do the ants climb plants on which *aphides* are to be found, but should they find the creature and not his saccharine produce, they will, with their antennæ, pat the aphis on either side of the abdomen until the desired drop is yielded, and then pass on to another. Linnæus quaintly styles the aphis the ant's *milch-cow*. The habitations of the ants are very curiously constructed, and display great ingenuity. Houses built by the common wood-ant (*Formica rufa*) are sometimes as large as a small haycock. They are generally found in the vicinity of some large tree on the bank of a stream; such a site affording them both food and the moisture requisite for building purposes. The ant-hill is of a conical shape, and composed of leaves, scraps of wood, earth, &c. At the commencement the nest is simply an excavation made in the earth; a number of the labourers wander about in quest of materials suitable for the superstructure, others carry out particles of earth from the interior, which are replaced by the bits of wood and leaves other labourers bring in, and which the builders properly arrange. Care is taken that space is left for the galleries that lead to the interior, while the dome contains a number of spacious apartments communicating with each other by means of galleries similarly constructed. To the superficial observer the exterior of an ant colony presents the appearance merely of a careless heap, the result rather of chance than of design. Minute inspection, however, would invariably discover it to be the very perfection of architecture, in which the attacks of enemies, the effect of wind and flood, and the rays of the sun, have been thoroughly provided against in the building. Some ants are popularly known as mason-ants for their skill in building; others, carpenter-ants, because they make their habitations in old trees, gnawing the wood into apartments and galleries with their partitions. Another species (*F. flava*) make partitions of a mixture of earth, sawdust, and spider's web. Cowdung and the leaves of trees are employed by other species. Ants are very pugnacious, and often fight fiercely. Party meets party, and after the fray may be found limbless trunks and trunkless heads, and combatants fast locked in each other's embrace, and quite dead. Most extraordinary than all, however, is the fact that some species of ants go on regular forays to carry off the eggs and grubs of other species, which they carry into captivity and rear as bond ants and slaves for the rest of their lives. The best known of these marauders are the Sanguinary Ant (*Formica sanguinea*) and the Amazon Ant (*Formica rufescens*). It has been noticed as a rather singular circumstance, that in both cases the kidnappers are red or pale-coloured ants, and the captives jet black.

ANT, WHITE, an extensive and important family of the *Neuropterous* order, chiefly confined to the tropics. They are very different from the ordinary ant. (*See* TERMITES.)

ANTARCTIC, *an-tark'-tik* (Gr., *anti*, against, or opposite to, and *arktos*, the Bear, or northern constellation), an expression applied to the south pole and Southern Ocean, as opposite to the north pole and Northern and Arctic Ocean, and especially to the region which lies around the antarctic or south pole, within a circle distant 23° 28′ from that pole; corresponding to an area similarly circumscribed which surrounds the north or arctic pole.

ANTARES, *an-tair'-ees*, a bright double star in the constellation Scorpio, marked α, and known as *Cor Scorpii*, the Scorpion's heart. It is remarkable for its brilliant red appearance.

ANT-EATER, GREAT (*Myrmecophaga jubata*, a genus of quadrupeds belonging to the natural order Edentata). This curious creature, sometimes called the ant-bear, is an inhabitant of most of the tropical parts of South America east of the Andes. It is the largest of the edentata, measuring four feet and a half from the tip of the snout to the root of the tail; while the latter member measures nearly three feet in length. The head of the great ant-eater extends to a long snout covered with skin, with only a very small opening at the tip for the protrusion of the tongue; its ears are very minute; its legs, especially the anterior ones, very stout and strong, and armed each with four long claws, which turn inwards against the sole of the foot. The hind feet are provided with a broad sole, and it is probably from this circumstance that the animal derives its occasional name of ant-bear. The body is covered with bristly hair, which, on the tail, grows to such a length as to sweep the ground. When composing itself for sleep, the ant-eater curls its body, and so enwraps itself in its bushy tail, as to present the appearance of a heap of withered grass rather than a living animal. Despite the animal's harmless appearance, it has a habit of suddenly rising, bear-fashion, and clasping its assailant round the waist, lacerating him fearfully with its powerful claws. The female produces one young at a birth, and carries it about for some time on her back. The natural food of the ant-eater is the white ant that abounds on the banks of lakes and rivers in tropical South America. Assailing the nests of the industrious insects with its heavy-armed fore-paws, it puts the entire colony in confusion, and then thrusting amongst them its nimble tongue, capable of protrusion to the extent of a foot and a half, withdraws the adherent ants, repeating the operation till they are all consumed, or the ant-eater's appetite satisfied. The ant-eater's tongue is composed almost solely of ring-like muscles, and is altogether worm-like in appearance. The surface is endued with viscous matter, to which the ants become helplessly attached at the slightest contact. The South African Aard-vark in some respects resembles the ant-eater. (*See* AARD-VARK.)

ANTECEDENTIA, *an-te-se-den-shi-a* (Lat., *antecedere*, to precede, to go before). When the motion of any heavenly body appears to be in a direction contrary to the course of the signs of the zodiac, or from east to west, it is said by astronomers to move *in antecedentia*.

ANTEDILUVIAN, *an-te-di-lu'-vi-an*. In Geology, the term is applied to the period before the final transformation of the surface of the earth by the action of water, but has no reference to the Mosaic deluge.

ANTELOPE, *an'-te-lope* (Lat., *antilope*), a large group of ruminating mammals, comprising many species, and classified together with sheep, oxen, and goats, as the family *Cavicornia* or hollow-horned ruminants. They are essentially distinct from the deer with which they are often confused; the horns of the deer being solid, composed wholly of bony tissue, and shed annually; while those of the *Cavicornia* are permanent through life. Although differing in many particulars from each other, all antelopes agree in certain important characteristics, as in the form of the horns, which are without angles and ridges, as is the case in the sheep and goat and other members of the *Cavicornia*, but of a round and annulated nature. Excepting in this particular, the horns of the antelope genus widely differ from each other; while those of one species are perfectly straight, another will exhibit curved or spiral horns. The female is usually endowed with these handsome appendages as well as its mate. All the antelopes are remarkable for their delicate sense of smell, and also for being the only family possessing the curious "lachrymal sinuses," or "tear-pits" of the eyes. These are small sacs situated beneath the eyes, and secreting a certain fatty substance. It was supposed that the possession of these tear-pits occasioned the very delicate sense of smell exhibited by all antelopes; but the anatomy of the parts fully proves that this theory is incorrect, and that there is no internal communication between the lachrymal sinus and the nose. The females are furnished with two and sometimes four teats, and the period of gestation varies from five to eight months. One, and occasionally two, are brought forth at a birth. From the most remote ages, the eyes of this genus have attracted notice. The Greek and the Roman name of the gazelle, *dorcas*, is derived from the verb *derkomai*, I see. Even the English name of the genus, antelope, is a corruption of the term *antholops*, literally "bright eyes." We are, moreover, informed by Bochart, that the Scriptural name, *tabitha*, is derived from *tzebi*, the Hebrew name of the gazelle, which alludes to the brightness of its eyes. The same image is frequently employed by poets. As a rule, the hair of the antelope is smooth and short, and of an equal length; but, in some species, they have manes on the neck and shoulders; others, as the gnu, are provided with a beard on the throat and chin. The ears are long and pointed, growing in the inside of which are long white hairs, forming five longitudinal lines, with four black spaces between. The tails are short, tufted at the extremity. This genus, as a rule, is gregarious, uniting in large flocks of thousands; but, in some instances, spending their lives in solitary pairs. When associating in large numbers, great caution is taken to prevent surprise, and sentinels are constantly kept on the alert. Their wariness in this particular, combined with their acute sense of smell and sight, renders them somewhat difficult game, tasking the patience and temper of the hunter to the fullest extent. The hunting-grounds of South Africa contain the largest number of these animals; Asia furnishes several species; Europe supplies but a small quota, the chamois being the best known; and the gigantic extent of pasture-land in the New World can boast of but two species, the so-called Rocky Mountain "goat," which is a true antelope, and the cabrit or prong-buck of the North American regions. Australia and Madagascar are totally destitute of antelopes, as of all indigenous ruminants. With regard to the habitat of the antelope, it is far from an uniform nature; the general characteristics are as variable as the structure of the animals. While some species delight in the parched and arid desert, feeding upon such bulbous plants as the nature of the soil affords, others find a home on the open plains, on the steppes of Central Asia, or karroos of Southern Africa. Another species prefers the mountainous districts, and exhibits all the ease and agility of the wild goat in their rocky home. The whole of the antelopes were at one time included under the general head *Antilopea*. Modern discoveries have so largely augmented the group, that it has been necessary to class them into subdivisions, as follows:—1, True antelopes; 2, bush antelopes; 3, capriform (or goat-like) antelopes; 4, bovine (or ox-like) antelopes. The two great divisions into which they are divided are, the *antelopes of the field* and the *antelopes of the desert*. They are principally distinguished in the former by the absence of hair on the nostrils, whilst the same organs of the latter division are covered within with hair or bristles. The antelope would appear to be the connecting link between the deer and the goat. In the peculiarity of never shedding their horns they resemble the goat; on the other hand, their fleetness, the colour and texture of their hair, their general structure, in fact, would place them near the deer tribe. The general colour of the antelope is brown on the back, and white under the belly, variegated with black stripes. With regard to the size of the antelope, while some of the largest species are some five or six feet in height, there is a singular little variety, the pigmy antelope, which scarcely measures nine inches. The whole tribe amount to about eighty species. Antelope flesh forms a considerable portion of the native's larder, as well as affording food to some thousands of the carnivora. In cases of severe drought, antelopes have been known to sweep down on the cultivated fields of the colonists in such flocks as to cause fearful devastations. The gazelle or North African or Barbary antelope has long been famed for its beauty; and from its extreme gracefulness of form, its gentleness of manners, and its bright black eye, it is and has long been a favourite subject of admiration by Eastern writers. Notwithstanding that it has often been spoken of as the wild gazelle, it has frequently been domesticated. The algazel is closely allied to the gazelle, and has graceful slender limbs, horizontal horns, obliquely annulated, nearly three feet in length. It is a native of Persia and Arabia. The addax is another North African antelope. The Chinese antelope, the *dzeria* of the Mongolian Tartars, is a native of the deserts lying between China and Thibet. It has short thick horns. The Chira, a native of Thibet, also of the Himalayas, possesses elongated and annulated horns, and a thick woolly coat. From the fact that one of its horns sometimes remains undeveloped, and, therefore, to the casual observer, the animal only appears to have one of these appendages, the mythical tales of the unicorn have arisen. The European representatives of the antelope are the chamois and the saiga. The latter, however, extends from Poland-Russia into Asia. But the principal home of the antelope is found in Southern Africa. Here are numerous varieties, perhaps the best known of which is the "spring-bok" of the Dutch settlers. The horns of this animal are curved like a lyre and annulate. It is famed for its great activity and powers of leaping great distances, hence its name "springer antelope," or spring-bok. It congregates in vast herds in the plains of Central and Southern Africa. "Bok" is the Dutch equivalent to "buck." The bontebok and the blesbok are two species closely resembling the spring-bok. Other species found in South Africa are—the blue antelope, the roan antelope, the water-bok (so called from its habit of frequenting rivers), the klippspringer (resembling our European chamois), the koo-doo, the eland, the wildebeest, the hartebeest, and the kudu.

ANTEMERIDIAN, *an-te-me-rid'-i-an* (Lat., *ante*, before, and *meridies*, noon or mid-day), before noon, or 12 o'clock in the day, used in its abbreviated form A.M. to denote any time between midnight and noon.

ANTENNÆ, *an-ten'-ne* (Lat., a yard-arm), the slender, jointed filaments with which the heads of insects are furnished, being synonymous with what are called feelers. It has been supposed that they are also organs of hearing, and without doubt it would appear that many insects possess the power of communicating, one with another, by means of them. (*See* INSECT, &c.)

ANTERIOR, *an-te'-ri-or*, designates before, either in time or place. In Anatomy, it is often used to designate parts which are situated before others, and is thus opposed to posterior; as, the anterior lobes of the brain, the *anterior intercostal nerve*

ANTHELIA, *an-the'-lia* (Gr., from *anti*, opposite to, and *helios*, the sun), luminous rings seen on clouds or fog lying opposite the sun, and usually attributed to the diffraction of light.

ANTHELIX, *an-the'-lix* (Gr., *antihelix*, from *anti*, opposite to, and *helix*, a spiral), an eminence on the cartilage of the ear, situated before, or more properly within, the helix, or outer circle of the ear. (*See* EAR.)

ANTHEMIS, *an'-the-mis* (Gr., the Chamomile plant), a genus of plants belonging to the natural order *Compositæ*, sub-order *Corymbiferæ*, and distinguished by having the scales surrounding the flower-heads membraneous at the borders, like those of a chrysanthemum, from which genus it differs chiefly in the receptacle of the flower being furnished with little chaffy projections. The most important plant of the genus is *A. nobilis*, the common chamomile, which is extensively cultivated for the sake of its flowers. It is an indigenous perennial, flowering from June to September, and growing on open gravelly pastures and commons. The *capitula*, which are commonly termed flowers, are each composed of a number of tubular yellow florets, arranged on a receptacle, and surrounded by a circle of ligulate white florets. The double variety is produced at the expense of the tubular florets, which become converted into ligulate florets. The single flowers are to be preferred for medical purposes, as the central yellow florets contain much more volatile oil than the white ones. Both leaves and flowers possess a strong but not unpleasant aromatic odour, and a nauseous bitter taste. The principal constituents of the flowers are volatile oil, tannin, and bitter resinous matter. The oil, which is procured by distillation, is stimulant and antispasmodic, and is frequently used in the preparation of tonic and cathartic pills, and to relieve flatulence. The dried flowers have the same properties as the oil, and are used for the same purposes. They are also employed externally for fomentations. A decoction of the flowers familiarly known as "chamomile tea" is a popular domestic medicine. The chamomile flowers of the German pharmacologists are the produce of a species of *Matricaria*, a genus very closely allied to the *Anthemis*. On the continent *A. nobilis* is called the Roman chamomile, to distinguish it from *M. chamomilla*, which is there generally known as the common chamomile. Great quantities of this plant are illegally used in the manufacture of beer. Two other species of *Anthemis* may be noticed—*A. Cotula*, the Mayweed, a common wild plant, sometimes mistaken for the chamomile, and so acrid as to blister the fingers if much handled; and *A. tinctoria*, which yields a yellow dye, much used in France by the dyers.

ANTHER, *an'-ther* (Gr., *antheros*, belonging to a flower), an essential portion of the stamen, being the bag or case which contains the pollen. It is generally supported on the summit of a little column or stalk called the *filament*. The pollen is discharged at certain periods through little slits or holes formed in the anther. (*See* STAMEN.)

ANTHERIDIUM, *an-the-rid'-i-um* (Gr., *anthos*, a flower), the general name applied to all the various structures in which, certainly or probably, the fertilizing function of reproduction resides in flowerless plants, and which consequently correspond physiologically to the anthers of flowering plants. All these organs have one character in common—namely, that of producing extremely minute bodies endowed with spontaneous motion when placed in water. These moving bodies from the antheridia are called spermatozoids, antherozoids, or spermatic filaments. (*See* SPERMATOZOID.)

ANTHESIS, *an-the'-sis* (Gr., flowering), a term sometimes used to indicate the period at which the flower-bud opens.

ANTHOCARPOUS, *an-tho-kar'-pus* (Gr., *anthos*, flower, *karpos*, fruit), a general term for fruits formed by the combination of several flowers. Such fruits usually consist not only of the carpels of the flowers, but of their bracts and floral envelopes as well, a fact indicated by the derivation of the term *anthocarpous*. The terms *multiple*, *aggregate*, ond *collective*, have also been applied to these fruits. The most important anthocarpous fruits are, the *cone*, which is seen in the fir, larch, spruce, and other plants of the order *Coniferæ*; the *galbulus*, seen in the cypress and juniper; the *strobilus*, seen in the hop; the *serosis*, in the pine-apple; and the *syconus*, in the fig. These fruits are described under their respective heads.

ANTHOCEROTÆ, *an-tho-se-ro'-te* (Gr., *anthos*, a flower; *kirkis*, a ray), a sub-order of the natural order *Hepaticaceæ*, the Liverworts, distinguished by having valved pod-shaped sporangia.

ANTHODIUM, *an-tho'-di-um*. (*See* CAPITULUM.)

ANTHOTAXIS, *an-tho-tax'-is*. (*See* INFLORESCENCE.)

ANTHOXANTHUM, *an-thox-an'-thum* (Gr., *anthos*, a flower, and *xanthos*, yellow), a genus of grasses. The species *A. odoratum* is commonly known as the sweet vernal grass, and greatly esteemed for its sweet smell, which causes much of the well known fragrance of new-mown hay.

ANTHOZOA, *an'-tho-zo'-a* (Gr., *anthos*, flower, *zooa*, animal), a class of that division of the animal kingdom termed *zoophytes* (animal-flowers). The *anthozoa* are divisible into three orders—*A. hydroida*, *A. asteroida*, and *A. helianthoida*. These so-called animal-flowers apparently, but not in reality, combine the animal and vegetable in their nature; for they possess the sense of touch, the power of voluntary motion, and usually feed on matters which they have swallowed or sucked in, digesting them in an internal cavity; thus completely exhibiting the attributes of an animal. (*See* ACTINIA and ZOOPHYTES.)

ANTHRACITE, *an'-thra-site* (Gr., *anthrax*, coal.—Anthracite, stone-coal, Kilkenny coal, culm, or coal-glance, is a very hard, lustrous variety of coal, found in the lowest parts of the carboniferous strata. It contains 90 to 96 per cent. of carbonaceous matter, and burns almost without flame, with a steady glow. Notwithstanding that it differs considerably from other kinds of coal, it is undoubtedly of vegetable origin like them, although it is nearly devoid of structure, and contains no impressions of plants. No distinct line of demarcation can be pointed out in the mine between the ordinary coal and the anthracite, as the one gradually merges into the other when they are found in the same seam. It has been spoken of as the ultimate product of the conversion of vegetable matter into coal. Its fracture is somewhat lamellar when broken in the direction of its bed, but irregularly conchoidal when broken across. Some specimens exhibit a beautiful play of colours, and are thence called peacock-coal. Being difficult of combustion, from its extreme hardness, it can only be burnt in a strong current of air. The coke obtained from it is very similar to the original coal both in bulk and weight. It is much used for steam boilers, and for various metallurgical operations, where a strong current of air is easily procured, and an intense heat is required. Anthracite is very abundant in the Welsh coal-fields, where excellent qualities are found. It also occurs in Kilkenny, and in enormous quantities in North America; but much of it is so compact that it cannot be used as fuel. In the neighbourhood of Bideford in North Devon, there occur a series of seams of clayey anthracite to which the name *culm* has been given.

ANTHRACOTHERIUM, *an'-thra-ko-the'ri-um* (Gr., *anthrax*, coal, *therion*, beast), a genus of fossil pachydermatous animals that seems to stand intermediate between the river-hog and the hippopotamus. The remains of the anthracotheria were first found in the tertiary lignites, or wood-coals of Liguria; hence the name given to this extinct animal.

ANTHRISCUS, *an-thris'-kus*, a genus of plants belonging to the natural order *Umbelliferæ*, and characterized by possessing little or no calyx, with heart-shaped petals bent down at their points; and by producing a fruit narrowed below the short beak, and without any ridges. The species *A. vulgaris*, the common beaked parsley, grows wild in waste places, and is sometimes confounded with hemlock, but may be easily distinguished by its paler colour, the slight hairiness of the leaves, and by the absence of spots on the stem, and the swelling under each joint. The species *A. cerefolium*, the garden chervil, was formerly cultivated as a potherb. *A. sylvestris*, the wild chervil, is a common weed in hedges and banks throughout England.

ANTHROPOLITE, *an-throp'-o-lite* (Gr., *anthropos*, man, *lithos*, stone), a term which has been applied to petrified human bones.

ANTHROPOLOGY, *an-thro-pol'-o-je* (Gr., *anthropos*, man, and *logos*, a discourse), is that science which in its widest sense treats of human nature both physically and mentally. It thus includes anatomy, physiology, psychology, ethnology, so far as they concern man, and even history, theology, æsthetics, &c. It is often, however, limited to the relations existing between the soul and body in man. This science has of late received much attention from some of our philosophers, and the word has come into very common use. The duty of anthropology is to gather from the various sciences before mentioned all the facts which they may be able to render concerning man, and elaborate from them, as completely as possible, a general view of human nature both physical and mental, also to present a theory of his life and actions from his first appearance here on earth. It was formerly the custom to exclude man entirely from other animals when pursuing these sciences, and to regard him as totally distinct from aught else; but of late years the human species has been regarded as the highest form and development of a long series of related organisms, and a much more perfect knowledge of man himself and his place in the universe has thus been gained. It is still a debatable subject, as to whether this plan shall be pursued with regard to the other sciences, and the mental, moral, and spiritual nature of man be regarded as wholly distinct from the lower animals, or as simply a higher development of them. Undoubtedly the break here between man and even the nearest animals to him in point of physical development is very vast, yet there are some philosophers who maintain that it is not absolute, and that germs of moral tendencies and of social law, reason, and noble instincts are to be discerned among the lower animals, and that the study of them may shed great light upon even the highest organization of man. (*See* EVOLUTION and ETHNOLOGY.)

ANTHROPOPHAGI, *an-thro-pof'-a-ji* (Gr., *anthropos*, and *phago*, I eat), cannibals, or man-eaters. (*See* CANNIBALS.)

ANTHYLLIS, *an-thil'-lis* (Gr., *anthos*, flower, *hulos*, beard), the kidney vetch, a genus of plants belonging to the natural order *Leguminosæ*. The silky appearance of the heads of flowers suggested the botanical name. *A. Vulneraria* is recommended as a herbage plant by some writers on agriculture.

ANTIARIS, *an'-ti-a-ris*, a genus of plants belonging to the natural order *Artocarpaceæ*. The species *A. toxicaria* is the celebrated antsjar, or upas poison-tree of Java, concerning which many fabulous and absurd stories have been told by travellers. (*See* UPAS.) The bark of *A. saccidora*, a tree growing in India, is used for cordage and matting. Sacks are also manufactured from it.

ANTIMOIC ACID. (*See* ANTIMONY.)

ANTIMONIOUS ACID. (*See* ANTIMONY.)

ANTIMONY, *an'-ti-mo-ne*, a brilliant bluish white metal, symbol Sb, from the Latin *stibium*; atomic weight 129, specific gravity 6·7. It fuses at 842° F. It is so brittle, that it may be reduced to powder by being pounded in a mortar. It occurs in commerce in crystalline cakes, and is generally very impure. It volatilizes at a red heat. It is a bad conductor of electricity and heat. When heated in air, it burns, and gives off copious white fumes, consisting of teroxide of antimony. It is also oxidized by nitric and sulphuric acid, and dissolved by aqua regia. In its chemical relations, it is allied to nitrogen, phosphorus, and arsenic, and forms, with the last, one of the connecting links between the metallic and non-metallic elements. Antimony is found pretty abundantly in nature, under the form of the grey ore, or tersulphide. The other ores of antimony are rare and unimportant.

ANTIPODES, *an-tip'-o-dees* (Gr. *anti*, and *pous*, a foot), is a term applied to those who live on opposite sides of the earth, and, consequently, have their feet turned towards each other. They are in similar but opposite latitudes, and their longitudes differ by 180°; and, consequently, while they have similar climates so far as dependant upon latitude, their seasons, as well as their days and nights, are reversed. The word is applied to places as well as to persons. The exact antipodes of London is a small island to the south-east of New Zealand, therefore known as London Island.

ANTIRRHINUM, *an-tir-ri'-num*, (Gr., *anti*, similar, *rin*, nose), a genus of plants, so named because the flowers of most of the species resemble the snouts of some animals. *A. majus* (commonly known as the snap-dragon), and its varieties, are popular border flowers, which can be cultivated without trouble in any dry soil. The genus belongs to the natural order *Scrophulariaceæ*, the Figworts.

ANTLER, *ant'-ler*, the term applied to the horn of the *Cervidæ*. Until the deer is a year old, nothing but a slight protuberance marks the place where the antlers sprout. In the second year the horn appears, and is called the *brow antler*; the next year it has a branch, and is known as the *bay antler*; the fourth year it has two branches, and is a *tray antler*; the fifth, another branch and a new name, *crockets*; and again, at the sixth year, when the antler is perfect and is called a *beam antler*. The deer's antlers are shed in spring; and, considering their size and weight, are renewed in an astonishingly short time. A full-grown stag's horn probably weighs twenty-four pounds; yet this large mass of true bone is reproduced in about ten weeks. The development of the deer's antlers is intimately connected with the sexual system. (*See* DEER.)

ANT-LION, *ant'-li-on* (*Myrmelon formicaleo*), an insect of the order *Neuroptera*, remarkable for its ingenuity in constructing a pitfall for the destruction of its prey. As soon as the young larvæ are hatched, they at once set about providing for their future sustenance. This is effected by turning round and round in the sand till a small cavity is made, which, as the animal increases in size and strength, grows broader and deeper, till it measures about thirty inches in breath and twenty in depth. If it meet with a stone it cannot remove, the excavation is deserted and another begun. At the bottom of this pit the ant-lion patiently remains, all its body, except the mandibles, buried in the sand, till some unsuspecting insect, arriving at the edge of the trap, thinks there can be no harm in exploring it. The sides of the pit, however, are so arranged as to afford foothold not even to the tiniest insect, and down rolls the little victim into the trapper's clutches; or, should it manifest any intention of escaping, a shower of sand, thrown up by a jerk of the ant-lion's head, at once arrests its progress, and brings it tumbling to the bottom again. It is entirely on the juices of insects that this voracious creature lives. The empty carcases are not allowed to encumber his abode. As soon as he has exhausted their fluids, he balances them in his strong jaws, and tosses them out. The larva remains in this condition during two years, being about half-an-inch long, with a large abdomen and small head; at the end of which time, having attained its full growth, it spins a cocoon, and takes the chrysalis form. Three weeks afterwards, it emerges a perfect insect. The ant-lion is, when full-grown, about an inch in length, and somewhat resembles the dragon-fly, except that it is much smaller. It has a very large abdomen and a very small head, which, however, is furnished with a pair of formidable incurved mandibles. It has six legs, but is incapable of rapid locomotion, and generally moves backwards. The perfect insect deposits its eggs in dry sandy situations. The *Myamelon foamiculeo* is not found in England, but occurs in many parts of the Continent, as France, Germany, Spain, &c.

AORTA. (*See* ANATOMY.)

APATITE, *ap'-a-tite* (Gr., *apatao*, I deceive). A mineral consisting mainly of phosphate of lime, and largely used of late years in the preparation of manures. It received its name from the fact that it is frequently mistaken for beryl, fluor spar, and other minerals, according to its colour and lustre, which vary considerably. It crystallizes in hexagonal prisms, modified sometimes on the edges, at others on the angles. It is a scarce mineral in England, though it occurs in some of the Cornish tin mines, and there is also a bed of it 18 inches thick at Llanfyllin in North Wales, from which large quantities have recently been taken. Fine specimens are found in Moravia, Bohemia, and Saxony, and extensive deposits have been found in various parts of the world: Krageroe in Norway and Estremadura in Spain have supplied great quantities. To fit it for the soil, it is reduced to a fine powder and then digested with sulphuric acid, which renders the phosphoric acid soluble in water, and facilitates its absorption by the corn or plant. Sometimes it is mixed with Peruvian guano, bones, blood, &c., and thus a mixed manure is produced which fertilizes the soil and enriches the corn much more than when the apatite or mineral phosphate is used alone. Different varieties contain a variable quantity of fluoride or chloride of calcium.

APE, *aip* (*Pithacus* of Linnæus), a genus of quadrumanous (four-handed) mammalia, most man-like in appearance and structure, such as the chimpanzee, the ourang-outang, the gorilla, &c. Formerly the term was almost synonymous with monkey and was used indiscriminately with it; now, however, according to the strict scientific zoological definition, the genus Ape, or *Pithacus*, comprehends only those four-handed mammals whose teeth are similar, both in number and form, to man's, and which have neither tails nor cheek-pouches. All the apes, however, present a striking difference from man in the formation of their great toe, which is so constructed as to resemble a man's thumb, the whole of the foot, moreover, is prehensile, like a hand, enabling them to clasp boughs. (For a notice of the most remarkable apes, *see* GORILLA, OURANG-OUTANG, CHIMPANZEE, &c.; for an account of species, &c., *see* SIMIADÆ, QUADRUMANA.)

APETALOUS, *a-pet'-a-lus* (Gr., *a*, without, and *petalon*, leaf), a term applied to a flower having but one whorl of floral envelopes; in other words, having a calyx, but no corolla.

APHAINTE, *a-faint'* (Gr., *a*, without, and *phaineia*, to appear), a tough compact rock, containing hornblende, quartz, and felspar, mixed so intimately as to be imperceptible—whence the name.

APHASIA, *a-fa'si-a.* Loss of speech in consequence of lesion of the brain. A much more serious disease than Aphonia (which *see*), for it is an absolute loss of the faculty of speaking. Perversion, or absolute loss of the power of expressing ideas by writing, is usually an accompaniment. It occurs in certain cases of paralysis of the right arm or leg. Often, after the lapse of a few weeks, recovery takes place if the patient is daily educated in simple words or short phrases, and the brain or paralytic affection improves.

APHELION, *a-feel'-yon* (Gr., *apo*, from, and *helios*, the sun), that point in a planet's orbit at which it is at its greatest distance from the sun. The rapidity of a planet's motion is least at its aphelion, and begins to increase after leaving that position, until it attains its maximum speed at the perihelion. (*See* PERIHELION, PLANET.)

APHIDÆ, OR APHIS, *af'-i-de* (Gr., *aphis*, a vine-fretter). A class of insects belonging to the order *Hemiptean*, sub-order *Homoptean*, and commonly known as plant-lice. They live by sucking the juices of plants, upon which they may be seen congregated in immense numbers. When attacked, the plant grows sickly, the leaves curl up, and the flowers and fruit, if not utterly destroyed, are certain to be seriously impaired. The cultivation of hops is notoriously an uncertain business, and this uncertainty may in great measure be attributed to the prevalence of the hop-fly (*Aphis Humuli*). So great are their devastations in some seasons, that the amount of duty paid upon hops has varied from £15,000 to £460,000; indicating, of course, a proportional variation in the crop. The Woolly Aphis, or American Blight, or Apple Aphis, was first observed in England in 1787, but it is not absolutely known whether it was actually imported from America, as has been supposed. It is, at times, very destructive to apple trees, and when once it appears, in garden or orchard, is very difficult of removal. It is a small insect, covered with a downy substance like cotton-wool; multiplies rapidly; clings to the chinks of the bark, and sucks the sap; causes diseased excrescences, and ultimately destroys the tree. There is an aphis that particularly affects turnips and cabbages, and one (*Aphis vastatoa*) that has earned for itself a world-wide notoriety as a blighter of potatoes. Most of the aphidæ are green; but that which attacks the bean (*Aphis Faba*) is black. They have a proboscis, by which they pierce and suck plants, and, at the extremity of the abdomen, two horn-like spines, from which exudes a saccharine fluid called *honey-dew*. The legs of aphides are long, and they move very slowly. Some are winged, and some are wingless, without distinction of sex. Their manner of propagation is very curious. In the autumn, male and female insects are found furnished with perfect generative organs, and the females lay eggs, which are hatched in the following spring. But, instead of producing insects of both sexes, these eggs give birth only to females, which, in their turn, produce living young without any congress with the male. The brood thus brought forth again produces young in the same manner; and this goes on throughout the whole summer, without the appearance of a single male insect. Happily their increase is kept under by the birds and by other insects which feed on them. Among the latter may be mentioned the familiar lady-bird.

APHONIA, *a-fo'-ni-a* (Gr., *a*, without, and *phone*, voice), loss of voice, very frequent in cases of common cold. There is no disease, simply a temporary mechanical defect, the muscles of the throat, brought into action by the mechanism of speech, being so affected by the cold, that for the time they refuse to perform their functions. A kind of aphonia sometimes appears in cases of hysteria.

APHRITE, *af'-rite* (Gr., *aphros*, foam), carbonate of lime occurring in scaly masses, having a peachy lustre and greasy feel; also called foam spa. This mineral must not be confounded with *meerschaum* (sea-scum), which is an amorphous carbonate of magnesia.

APHRODITA. (*See* SEA-MOUSE.)

APIACEÆ, *ai-pi-ai'-see*, a name sometimes given to the natural order *Umbellifeæ*, which *see*.

APIARY. (*See* BEES.)

APIOCRINITE, *ai-pi-ok'-ri-nite* (Gr., *anioa*, a pear), a term applied to a kind of encrinite peculiar to the chalk and oolitic formations, and distinguished by a pear-shaped receptacle. (*See* ENCRINITE.)

APIOS TUBEROSA, *a'-pi-us tu-ber-o'-sa*, a plant pertaining to the natural order *Leguminosæ*, sub-order *Papilionaceæ*. It is a native of Virginia, and has been cultivated in botanic gardens in Europe with some success. In many respects it resembles the potato, having similar tuberous roots, which taste like potatoes when cooked in steam. They are, however, more nourishing. Its ordinary cultivation is very difficult.

APIS, *ai'-pis*, the Bee. (*See* BEES.)

APIUM, *ai'-pi-um*, a genus of plants belonging to the natural order *Umbelliferæ*. The common celery, *A. graveolens*, is the only important species. This plant grows wild in almost every part of Europe; but it is quite unfit for food until cultivated with absence of light, when the stem and petioles become succulent, white, and wholesome.

APOCARPOUS FRUITS, *ap'-o-kar'-pus* (Gr. *apo*, separate, *karpos*, fruit), those fruits which are each formed of a single carpel, but of which several are produced by a single flower. The simple solitary fruits are generally included under the same head; but the most accurate botanists have kept them distinct. Three kinds of apocarpous fruits are distinguished, and these are respectfully termed the *Follicle*, the *Achæhium*, and the *Etærio*. (*See* these words.)

APOCOPE. (*See* APHÆRESIS.)

APOCRENIC ACID, *ap'-o-kre-nik*, an acid found in mould produced by the decay of leaves, wood fibres, and other plant textures. It retains ammonia with great tenacity, thus affording nourishment to the plants in its vicinity. Crenic, geic, ulmic and humic acids are found in similar situations, and possess similar properties.

APOCYNACEÆ, *a-po-si-nai'-se-e* (Gr., *apo*, against, *kuon*, dog), the Dogbane order of dicotyledonous plants, included in the sub-class *Corolliflorœ*, trees or shrubs generally having milky juices. The Dogbanes—of which there are 108 genera and 570 known species—are natives principally of tropical regions, a few only occurring in northern latitude. *Vinca*, the periwinkle, is the only British genus. The Oleander, however, is found in Southern Europe. Some of the plants of this order are intensely poisonous, of which the noted Tanghin tree of Madagascar is a famous example; all are to be suspected, though a few yield edible fruit. Some are drastic purgatives, and in some the bark is tonic and febrifugal. The milk of some of them, however, is bland and wholesome, as for instance Hya-Hya or Cowtree of Demerara. They have usually large showy flowers, and are on that account cultivated in our hothouses. Caoutchouc, or India-rubber, is prepared from the milky juice of several species.

APOCYNUM, *a-po-sy'-num*, the typical genus of the natural order of plants *Apocynaceæ*. *A. cannabinum* is the Canadian hemp, an herbaceous plant from four to five feet in height, with an unbranched stem bearing oblong leaves, and cymes of whitish flowers. It yields a very strong fibre which the Indians of North America employ for making twine and coarse cloth. The roots of this species and *A. androsæmifolium* are emetic, and slightly purgative.

APODAL FISHES, *ap'-o-dal*, fishes destitute of ventral fins; the eel is an example.

APOGEE, *ap'-o-je* (Gr., *apo*, from, and *ge*, the earth), means the greatest distance of any heavenly body from the earth; but it is applied more particularly to the sun and moon. The opposite condition is PERIGEE.

APONEUROSIS, *ap-o-nu-ro'-sis* (Gr., *apo*, from, *neuron*, a tendon), the membrane or tendon by which the muscles are attached to a bone, called aponeurosis of insertion. The term is also applied to a membrane within the substance of muscular fibres, called aponeurosis of intersection; also to a membrane surrounding a muscle and preventing its displacement, called enveloping aponeurosis.

APOPHYLLITE, *a-pof'-il-lite* (Gr., *apophullizo*, to strip of leaves), called also the "fish-eye stone," a mineral occurring in white, pearly, square prisms or pyramids. It is a silicate of lime and soda, and is found in the magnetic iron deposits of Sweden and Norway. So named from its tendency to exfoliate under the blowpipe.

APOPLEXY, *ap-o-plex'-e* (Gr., *apoplexia*, a sudden blow, a privation of sense and motion), is the name of a disease characterized by a sudden abolition or great diminution of the powers of sensation and voluntary motion, while the organic functions of the body—circulation, respiration, secretion, &c., are still carried on, but usually in a more or less impaired state. The attack is sometimes instantaneous; at other times it comes on by degrees. The face is generally flushed; the breathing slow, deep, and stertorous, the pulse fuller, stronger, and slower than natural, and the skin covered with a cold clammy perspiration; sometimes, however, the pulse, instead of being full and strong, is weak and intermitting, and the face pale and dejected. Apoplexy springs from a diseased condition of the brain, and is occasioned by whatever unduly impedes or accelerates the circulation of the blood within the brain, or exerts a certain degree of pressure upon it. Hence, violent exertion, either of mind or body, great mental anxiety, intemperance in eating or drinking, are among the exciting causes of it. Males are much more liable to it than females, and it is most common between the ages of fifty and seventy. Though the attack is usually so sudden, it is not without its premonitory symptoms, which, though numerous and diversified, are yet obvious and easily understood. Among these, are excessive drowsiness, giddiness and headache, with frequently dulness of hearing, imperfect or disordered vision, noise in the ears, loss of memory, &c. Sometimes the attack is preceded by paralysis affecting the speech, hands, feet, or other part of the body, and frequently it is succeeded by paralysis. When judicious remedies are adopted in time, an attack may generally be averted or rendered comparatively mild. Until medical assistance can be obtained, the patient's head should be raised, the head and neck bared, and the freest circulation of fresh air promoted; and, as soon as possible, purgative medicines should be administered. The attack may last from a few hours to two or three days; and, even when it does not destroy life, it usually gives a shock to the constitution, which is seldom entirely recovered from.

APOSTASIACEÆ, *a-pos'-ta-si-ai-se-e*, a natural order of plants, named after the genus *Apostasia*, and belonging to the class *Monocotyledones* and sub-class *Petaloideæ*. Herbs with regular hermaphrodite flowers, growing in the damp woods of tropical India. There are three genera and five species.

APOTHECIA, *a-po-the'-shi-a* (Gr. *apotheke*, a repository), the term applied to the spore-fruits of lichens. These contain the *thecæ*, or spore-cases, and occur either as little nodules and raised lines, or as round, shield-shaped, and cup-shaped bodies scattered over the fronds.

APPARENT, *ap-par'-ent* (Lat., *apparere*, to appear), an expression used in Astronomy to denote things as they seem to be to an observer, in contradistinction to their actual or real state. The term is applied principally to diameter, distance, figure, and motion.

Apparent Diameter of a body is the angle formed by two lines drawn from opposite points in the circumference of its disc to the eye; and the apparent magnitude of a body is similar, being the angle formed by two lines drawn to the eye from its opposite extremities. The apparent diameter and magnitude of bodies vary according to their distance from the eye.

Apparent Distance is the distance at which we judge or imagine heavenly bodies to be from us. The apparent distance of the heavenly bodies appears to us to be the same, or nearly so, in all cases, though really so widely different.

Apparent Figure is the shape which an object presents when viewed under different circumstances.

Apparent Conjunction is when one heavenly body comes directly in the line between another heavenly body and the eye of an observer.

Apparent Horizon is the circle which appears to bound the view on all sides, seen most perfectly at sea.

Apparent Noon at any place is the time when the sun is on the meridian of the place in contradistinction to true or mean noon, when the sun would be on the meridian if it moved in its apparent orbit with uniform velocity. (*See* EQUATION OF TIME.)

Apparent Motion is that which bodies appear to have to an observer who is himself also moving. The motions of the sun in the heavens are apparent motions.

Apparent Time. (*See* TIME.)

APPETITE, *ap'-pe-tite* (Lat., *appeto*, I desire), a desire of enjoying something that is apprehended or felt to be necessary or conducive to happiness. In its primary sense, and as used by the Latins, it comprehended every species of desire, whether of a mental or corporeal nature; now, however, it is usually applied only to corporeal desires. Appetites are distinguished from passions in being directed to general objects, while the latter are directed to special objects. Thus we speak of an appetite for fame, glory, or riches. They are also distinguished from passions in the latter having no existence till a proper object be presented; whereas, the former exists first, and then is directed to an object. Natural appetites are given for the preservation of the individual or the propagation of the species. Besides the appetites which nature has given to us for useful and necessary purposes, we may create others which nature never gave, and which are often very hurtful. Appetites seek their gratification without the aid of reason, and often in spite of it. In common language, the term frequently means a vigorous desire of food, and a healthy capacity for enjoying it.

APPLE, *ap'-pel* (Ang.-Sax., *appl*), the fruit of the *Pyrus Malus*, a tree belonging to the sub-order *Pomaceæ*, of the natural order *Rosaceæ* (*See* PYRUS.) All the different kinds of apple-trees now in cultivation are usually regarded as mere varieties of the one species which in its wild state is known as the crabtree. This plant is a native of Britain, and is found in most of the temperate parts of the northern hemisphere. Its fruit is uneatable, but is sometimes collected for the sake of its acid juice, which, when fermented, forms the liquid called *verjuice*, used in cookery and for purifying wax. The cultivated tree was probably introduced into Britain by the Romans, who are said to have had twenty-two varieties. At the present time it is, perhaps, the most widely-diffused, and most valuable of all fruit-trees; and the varieties, which are adapted to almost every soil, situation, and climate in the temperate zone, have become extremely numerous. The apple-tree seldom reaches a greater height than thirty feet, but its large round head makes up for the want of height; and, altogether, it is a noble-looking tree, especially when in full blossom. The flowers grow in bunches, and are very fragrant. They are white inside, and delicately tinged with pink externally. The tree is not always permitted to ramify in a natural manner, but is sometimes trained as an espalier, or as a wall-tree. New varieties are continually being developed; and, as they are generally propagated by grafting, the old ones gradually die out. The variety that produced the *costard*, which was formerly a favourite kind of apple, does not exist at the present time, though we still retain the name of costermongers (*costardmongers*) for itinerant sellers of apples and other fruits and vegetables. The apple is usually grafted on apple or crab stocks; but sometimes hawthorn stocks are used. For producing dwarf trees, stocks of the paradise apple, a very diminutive variety, are generally employed. The apple (we now allude to the fruit, and not to the tree producing it) varies greatly in size, form, and colour. It is regarded by botanists as the type of the kind of fruit to which they have applied the term *pome*. (*See* POME.) The eatable part has a more or less aromatic, sweet, or sub-acid taste, and contains starch, grape-sugar, and malic acid. Apples are commonly divided into dessert, baking, and cider fruits, the first being highly flavoured, the second such as become soft in baking or boiling, and the third those which are hard and austere. Apples are also classed under the general names of Pippins, Pearmains, Rennets, Calvilles, Russets, Codlins, &c. Large quantities of apples are imported into England from France, Canada, and the Northern States of America. The apple of Scripture, mentioned in the "Song of Solomon," was probably the citron. The uses of the apple—for the dessert, for puddings and pies, for preserving and making jelly—are sufficiently well known. Cider, the fermented juice of the apple, is a favourite drink in many parts of England and France. Malic acid, extracted from the apple, has long been used in medicine, and has latterly been largely employed as a mordant in dyeing. (*See* CIDER, MALIC ACID.)

Apple of Love. (*See* TOMATO.)

Appleberry. (*See* BILLARDIERA.)

Apple-Moth (*Carcocopsa pomonella*), one of the most destructive enemies of the apple crop in this country. It lays its eggs in the eyes of the newly-formed fruit, within which the larva feeds. The result is the premature falling of the apple.

Apples of Sodom.—A name given to a fruit, of somewhat fabulous properties, growing, or supposed to grow, "near that bituminous lake where Sodom stood." Josephus, in describing it, endows it with many marvellous characteristics; such as, that, on the fruit being plucked with the hands, it is dissolved into smoke and ashes. It is a kind of gall, about two inches long, growing on dwarf oaks, and produced by a species of gall insects known as *Cynips insana*. The apple is filled with a bitter poison, an easily pulverized substance surrounding the insect. (*See* SOLANUM.)

APPROXIMATION, *ap-prox'-i-mai'-shon* (Lat., *ad*, to, *proximus*, next), in Arithmetic and Algebra, the coming nearer and nearer to a root or other quantity sought, without finding, or expecting to be ever able to find it exactly. By approximation the value of a quantity may be found, if not to the utmost degree of exactness, sufficiently so for practice.

APRICOT, *ai'-pri-kot* (Lat. *præcox*, blossoming early), the popular name for *Prunus Armeniaca*, a fruit-tree belonging to the same genus as the plum. It is a native of Armenia, and the countries eastward, to China and Japan. It blossoms at the very commencement of spring, and bears a fruit resembling the peach, but with yellow flesh. It appears, from Turner's "Herbal," that the apricot was cultivated in Britain in 1562; and in Hakluyt's "Remembrancer," 1582, it is affirmed that it was first brought here from Italy, by Wolfe, a French priest, gardener to Henry VIII. Upwards of twenty varieties are now in cultivation. The trees are generally budded on plum or wild cherry stocks and trained against the walls. The dried fruits are exported from Italy and the south of France. From the bitter keracls which contain prussic acid, the *eau de noyaux* is distilled in France.

A PRIORI, *pri-or'-i*, is a term in Logic, taken from the Latin, and signifying, literally, "from a thing before" as opposed to *a posteriori*, "from a thing after." They distinguish the two different methods of reasoning, the former being applied to arguments from cause to effect, the latter from effect to cause; the one lays down some previous self-evident principles, and then descends to the several consequences that may be deduced from them; the other begins by regarding the phenomena themselves, traces them to the original, and, by developing the properties of these phenomena, arrives at the knowledge of the cause. Kant applies the term *a priori* to knowledge which is absolutely independent of all experience, as opposed to empirical knowledge, or knowledge derived *a posteriori*, through experience. In this sense, the terms are now commonly used by philosophers.

APSIDES, *ap'-si-dees* (Gr., *apsis*, arch, connection), the points in the orbit of a planet, or any heavenly body, at which it is at its least and greatest distance from the sun or body round which it revoles as a centre. The apsides of a planet are its aphelion and perihelion, and those of the moon, its apogee and perigee. (*See* APHELION, PERIHELION, APOGEE, PERIGEE.)

APTEROUS INSECTS, insects without wings; formerly considered as a separate order, but the distinction is not observed by modern naturalists.

APTERYX, *ap'-te-rix*, a genus of birds allied to the ostrich and emu, and, perhaps, more nearly to the extinct dodo. It has a long spike-bill, of which it makes use in supporting itself when at rest. Its wings are simple rudiments—a mere stump, terminated by a hook. Its feathers fall loosely, like those of the emu. Only one species is known (*A. Australes*), a native of New Zealand. It is a nocturnal bird, and preys on snails and insects. The feathers are much prized. The natives call it *Kivi-kivi*, from its peculiar cry.

APTHŒ, *ap'-the*, small vessels formed of the superficial layer of the mucous membrane, caused by fluid secreted by the latter; they are very painful. The complaint to which infants are liable, known as the thrush, is of this character. (*See* THRUSH.)

AQUAMARINE, OR BERYL, *ai-qua-ma-reen'*, a precious stone, much valued as a jewel. (*See* BERYL.) The name is sometimes given to green and blue varieties of the topaz. (*See* TOPAZ.)

AQUARIUS, *a-quair'-i-us* (Lat., water-bearer), a constellation, and the eleventh sign of the zodiac, giving a name to that part of the ecliptic in which the sun is in the latter part of January and the beginning of February. The sign is supposed to have been so called because the weather is generally rainy when it appears on the horizon.

AQUATIC, *a-quat'-ik*, a term applied to plants and animals that live either wholly or partly in water. All plants growing in water may be termed *aquatic;* but, by botanists, the term is usually applied only to those found in *fresh* water, either stagnant or running; as, *Sagittaria*, arrowhead; *Nymphæa*, water-lily; *Potamogeton*, pondweed; *Sabularia*, awlwort; *Utricularia*, bladderwort; *Stratiotes*, water-soldier; *Lemna*, duckweed; the *Confervæ*, and *Oscillatoriæ*. Some of these root in the soil, and appear above the surface of the water; others root in the soil and remain submersed; while others, again, swim freely on the surface, without rooting below. Aquatic animals must not only breathe air, but are adapted for spending great part of their existence on dry land, and are chiefly those that seek their food on water. The peculiarities of structure by which they are fitted for wading, for swimming, for diving, such as the web-feet and plumage of water fowls, the fur of the beaver and otter, and other animals of the clan, are very remarkable.

AQUEOUS HUMOUR, *ai'-que-us*, that watery fluid of the eye which is situated between the back of the cornea and the front of the lens. (*See* EYE.)

AQUEOUS ROCKS, are those which have been formed by deposition from water; in other words, they are the *sedimentary* or *stratified* rocks. Unstratified rocks which have arisen through fusion, are termed, in contradistinction, *igneous*.

AQUIFOLIACEÆ, *ai'-qui-fo'-li-ai'-se-e* (Lat., *folium*, leaf), the holly family, a natural order of dicotyledonous plants, in the sub-class *Corolliflora*. They are evergreen trees or shrubs, with coriaceous and simple leaves, which have no stipules. The flowers are small, axillary, and sometimes unisexual; the fruits fleshy and indehiscent. There are eleven genera and one hundred and ten species, which are widely, although sparingly, distributed over the globe, chiefly in America. Only one species, the common holly, is found in Europe. Bitter, tonic, and astringent properties are commonly possessed by plants of this order. Some are emetic and purgative, while others are largely used as substitutes for China tea. (*See* ILEX.)

AQUILA, *a'-qui-la* (Lat., eagle), the name of a constellation in the northern hemisphere, above the signs of Aquarius and Capricornus.

AQUILARIACEÆ, *a-qui-lair'-i-ai'-se-e* a natural order of dicotyledonous plants, in the sub-class *Monochlamydeæ* There are but six genera and ten species, all natives of tropical Asia. They are handsome trees, with smooth branches and very tough barks. The typical genus is *Aquilaria*, certain species of which yield the fragrant eagle-wood, or aloes-wood, supposed to be the calambac or agallochum of the ancients, the ahalim or aholoth of the Old Testament, and the aloe or aloes of the New. This wood was formerly held in high repute as a medicinal agent in Europe ; but its use is now obsolete.

AQUILEGIA, *a-qui-le'-ji-a* (Lat., a gutter), a genus of plants belonging to the natural order *Ranunculaceæ*. The name *Aquilegia* was given to the genus by the ancients, because the leaves are so shaped that they collect the rain which falls upon them, and retain it for some time. The species are commonly called Columbines, and several of them are cultivated in flower-borders, being handsome perennials. The petals are curiously formed, having each a long curved horn or spur at the base.

ARA, *air'-a* (Lat., altar), in Astronomy, a constellation in the southern hemisphere, not visible in our latitude.

ARACEÆ, *a-rai'-se-e*, the Arads or Arum family, a natural order of monocotyledonous plants, in the sub-class *Petaloideæ*—herbs or shrubs with acrid juices and subterranean tubers, corms, or rhizomes. Their leaves are sheathing, usually net-veined and simple, but in rare instances compound. Their flowers are monœcious (male and female organs in separate flowers), and they are arranged on a spadix within a spathe. The order embraces 30 genera and 170 species. The Arads abound in tropical countries, and some few occur in cold and temperate regions. They are all more or less acrid, and often highly poisonous. The type of the order is the genus *Arum* (which *see*).

ARACHIS, *ar'-a-kis*, a genus of plants belonging to the natural order *Leguminosæ*, sub-order *Papilionaceæ*. The species *A. hypogæa*, a native of the tropical portion of America, is remarkable for ripening its legums under the surface of the ground, which characteristic is indicated by the names *underground kidney-bean* and *ground-nut*, commonly given to it. After flowering, the flower-stalks elongate and bend towards the earth, into which the pods penetrate. Each pod contains two, three, or four seeds, which, when ripe, are about the size of hazel-nuts. These seeds are used as food in various parts of the world; for the plant is now cultivated in Africa (very extensively on the west coast), Asia, and certain portions of Europe, especially France, as well as in its native regions. On being subjected to pressure, the seeds yield a fixed oil, which is extensively employed for cooking in India, where it is called katchung oil. Being a very liquid oil, it has been used in this country for watches, and other delicate machinery, as well as for burning and other purposes. It is also much used in Spain in the manufacture of soap and chocolate.

ARACHNIDA, *a-rak'-ni-da* (Gr., *arachne*, a spider, and *eidos*, form or likeness), a class of articulated animals generally regarded as intermediate between insects and crustacea, differing from the former in respect of having the head and thorax united in one piece ; and from both in having simple eyes and in the absence of proper antennæ. Some breathe by means of pulmonary cavities, others by trachæa like insects ; and upon this difference is founded the primary divisions into two orders—*Pulmonaria* and *Trachearia*. To the first of these orders, spiders and scorpians belong; acari to the the second. (*See* ACARUS, MITE, SCORPIAN, SPIDER, and TICK.)

ARACHNOID MEMBRANE, *a-rak'-noid* literally one of the three membranes which envelop the brain and spinal cord. It is situated between the dura and the pia mater, and is a thin glistening membrane. Between the pia mater and the arachnoid membrane there are in some places spaces filled with a fluid known as cerebro-spinal, the presence of which is necessary to the proper action of the nervous centres. (*See* CEREBRO-SPINAL FLUID.)

ARALIA, *a-rai'-li-a* a genus of plants belonging to the natural order *Araliaceæ*. It contains a considerable number of species—trees, shrubs, and herbs, some of which yield useful products. *A. nudicaulis*, is a native of North America, where its roots are used popularly in the treatment of rheumatic effections. They are commonly known as false or American sarsaparilla, and are sometimes forwarded to this country. The bark of *A. spinosa*, the angelica or toothache-tree, and also a native of North America, is used as a stimulant diaphoretic ; and the berries, infused in wine or spirits, are employed as a cure for rheumatism. *A. polaris*, a native of New Zealand, a shrub grown to the height of about five feet, is, from its orbicular masses of green foliage and waxy flowers, very handsome. From the pith of *A. papyrifera* the Chinese prepare their so-called rice paper. The roots of the *A. edulis* (or *Dimorphanthus edulis*), are eaten in Japan as carrots and parsnips are in Europe. Several species of *Aralia* yield aromatic gum-resins.

ARALIACEÆ, *a-rail-i-ai'-se-e*, Ivy-worts, a natural order of dicotyledonous plants, in the sub-class *Calycifloræ*—trees, shrubs, or herbs closely allied to the umbelliferous plants, but not possessing, in the slightest degree, the poisonous properties so commonly found in those plants. There are 21 genera and 160 species, which are universally distributed ; being found in tropical, sub-tropical, temperate, and the coldest regions. The most interesting genera are described under their respective botanical names. (*See* ARALIA, HEDERA, IVY, PANAX.)

ARAPAIMA, *a-ra-pai'-ma* a genus of fresh water fishes, the largest known sometimes attaining a length of 15 feet. They are found in the rivers of South America, and are taken with a harpoon. They are allied to the herrings, and belong to the family of *Clupesocidæ*. When salted, they are used as food. About six species are known.

ARAUCARIA, *a-raw-kair'-i-a*, a genus of plants belonging to the natural order *Pinaceæ* or *Coniferæ*, the Pines, consisting of gigantic trees, natives of the southern hemisphere, and distinguished by having the male and female flowers on separate plants. The species are all evergreen, and their leaves are considerably broader than those of the ordinary pines and firs. *A. excelsa* (more frequently named *Eutassa excelsa*), commonly called the Norfolk-Island pine, is a most majestic tree, growing to a height of from 160 to 220 feet, and having sometimes a circumference of more than 30 feet. Its timber is white, close-grained, but remarkably heavy, and seldom sound for a great length; the bark abounds in turpentine. This tree occurs in Norfolk Island, New Caledonia, and some parts of Australia. *A. imbricata*, the Chili pine, has been introduced into this country as an ornamental tree, and is now frequently planted on lawns and in shrubberies. Its seeds are edible, and are extensively used for food by the natives of Chili and Patagonia. It is said that the fruit of one large tree will maintain eighteen persons for a whole year. This tree was first found growing on the mountains of the Araucanian Indians, in South America: whence the name of the genus.

ARAUCARITES, *a'-raw-ka-rites*, a term applied to specimens of fossil wood, resembling in structure that of living Araucaria. These fossils are common in the carboniferous strata of Great Britain.

ARBORESCENT, *ar-bo-res'-ent* (Lat. *arbor*, a tree), a term applied to crystals that assume a tree-like form. A small quantity of milk added to a solution of any salt will alter its crystallization to the arborescent form. Very beautiful arborescent metallic crystals may be formed for the microscope by placing an atom of copper in a drop of nitrate of silver, placed on a glass slide. The Arbor Dianæ, or silver-tree, is made by dropping a few globules of mercury into a clean glass bottle, containing a solution of nitrate of silver. If left undisturbed for a few days, beautiful arborescent forms of metallic silver rise from the surface of the mercury, continuing to increase as long as there is any nitrate of silver left in the liquid. (*See* CRYSTALLIZATION.)

In Botany, the term is applied to plants possessing altogether, or in some measure, the character of trees. (*See* TREE.)

ARBOR VITÆ, *ar'-bor vi'-te* (Lat., tree of life). (*See* CONIFERÆ and THUJA.)

ARBUTUS, *ar-bu'-tus*, in Botany, a genus of plants belonging to the natural order *Ericeæ*, consisting of small trees and shrubs, most of them natives of America. The fruit is fleshy and many-seeded; in some species resembling in shape and colour that of the strawberry. The corolla is urn-shaped. The most remarkable species is *A. unedo*, which is a native of the south of Europe and the Levant, but now found also in Asia and America. It is cultivated as an ornamental evergreen-tree in Britain and in Ireland (especially near the lakes of Killarney), where it frequently attains the height of nearly twenty feet. It is commonly called the strawberry-tree. *A. andrachne*, the Oriental arbutus, is even more elegant than the common species; but, at the same time, it is much more delicate, and will not thrive in our variable climate. Its fruit is eaten in Oriental countries. *A. furens* is a small shrub growing in Chili, and yielding a fruit having strong narcotic properties. *A. aculeata*, is a beautiful shrub, which abounds at Cape Horn and on Staten Island, near New York. The red and black bearberries, growing in the north of Europe and Asia, belong to this genus.

ARC, *ark* (Lat., *arcus*, a bow), signifies any part of a curved line. The straight line which joins the extremities of the arc, is called its chord. The practical operation for finding the length of an arc is as follows:—Divide the arc into a number of smaller arcs, making the number large in proportion to the degree of accuracy required, then add together the chords of the smaller arcs. The sum of the chords will differ but little from the arc, even when the subdivisions are not numerous. For every practical purpose, an arc of a circle—and the same may be said of every other curve—is the polygon made by the chords of a moderate number of subdivisions of the arc.

Arc of the Meridian, the curve between any two points of a meridianal line on the surface of the earth, and the form of the curve indicates the size and configuration of the entire globe. Many measurements of arcs have been taken and very exact results arrived at. (*See* MERIDIAN.)

Diurnal and Nocturnal Arcs, the parts of a circle described by a celestial body between its rising and setting and setting and rising.

Arc of Progression, an arc of the zodiac which a planet appears to pass over when its motion is according to the signs.

Equal Arcs are those which contain the same number of degrees and the radii of which are equal.

ARCA, OR ARK-SHELL, *ar'-ka*, a genus of bivalve shells and mollusca, the type of the *Arcadæ*. One species is found on the British shores. Fossil *arcadæ* are very numerous.

ARCHÆOCIDARIS, *ar'-ke-o-sid'-a-ris* (Gr., *archaios*, ancient, *kidaris*, turban), a genus of turban-shaped sea-urchins, found in a fossil state, in carboniferous and Permian strata. (*See* CIDARIS.)

ARCHÆONISCUS, *ar'-ke-o-nis'-kus* (Gr., *archaios*, ancient; Lat., *oniscus*, woodlouse), a genus of fossil crustaceans, occurring in the Purbeck strata, and bearing considerable resemblance to the common woodlouse.

ARCHANGELICA, *ark-an-jel'-i-ka*, the herb Archangel, a genus of plants belonging to the natural order *Umbelliferæ*. The species are mostly herbaceous and perennial, natives of the cold and temperate regions of the northern hemisphere. *A. officinalis*, the garden angelica, is an indigenous biennial, growing in watery places, but somewhat rare in this country. It grows in moist situations, and flowers from June to September, the blossoms being greenish-white. Its root is large and fleshy, resinous, and pungently aromatic. It is imported from Hamburg in the dried state for medicinal purposes, being stomachic and carminative. The plant is cultivated for the purpose of candying in the neighbourhood of London. Large quantities of angelica are consumed by the rectifiers in the preparation of London gin and the liquor known as "bitters."

ARCHEGOSAURUS, *ar'-ke-go-saw'-rus* (Gr., *archegos*, leader, *sauros*, lizard), the name signifying "primeval lizard," given by Goldfuss to a reptile of the Carboniferous era, allied to the existing reptiles, the proteus and lepidosiren. It exhibits a blending together of the characteristics of reptile and fish in one animal. The first specimen, found in the coalfields of Bavaria, was described by Agassiz as a fish.

ARCHER FISH, a curious little fish, the *Toxotes jaculator* of the family of *Squamipennes*, or *Chætodontidæ*, inhabiting the Indian and Chinese seas. Lurking near the surface of the water, it awaits the approach of an insect, and then suddenly squirts at it a drop of water, which infallibly brings it down. It is about seven inches long, and has a wide mouth, with the lower jaw considerably prolonged. Another Javanese fish, the *Chelmon rostratus*, possesses the same power of forcibly ejecting a drop of water. The Chinese keep them in jars, and amuse themselves by watching the effect of suspending a fly above a jar with a thread.

ARCHIL PLANT. (*See* ROCELLA.)

ARCHIMEDES, *ar-ki-me'-dees*, PRINCIPLE OF, a celebrated principle in the science of Hydrostatics, the discovery of which is attributed to the Syracusan philosopher whose name it bears. This important theorem may be thus expressed: when a solid is immersed in a fluid, it loses a portion of its weight, and this portion is equal to the weight of the fluid which it displaces, that is, to the weight of its own bulk of the fluid. The application of this theory is one of the means by which the specific gravity of solids is ascertained. (*See* SPECIFIC GRAVITIES.)

ARCTIA CAJA. (*See* TIGER-MOTH.)

ARCTIC, *ark'-tik* (Gr., *arktos*, a bear), in Astronomy, a term applied to the north pole, or the pole raised above our horizon. It receives its name from the constellation of the Little Bear, the last star in the tail of which nearly points out the north pole.

ARCTIC CIRCLE, in Astronomy, a circle of the sphere parallel to the equator, and distant from the north pole 23° 30'. This and its opposite, the Antarctic Circle, are also called the Polar Circles, wherein the longest day and longest night are 24 hours, and within which at one time of the year the sun never sets, and at the opposite season never rises. (*See* PHYSICAL GEOGRAPHY.)

ARCTIC FOX. (*See* FOX.)

ARCTITIS, *ark-ti'-tis*, or weasel-bear, a genus of marsupial animals, consisting of two Indian species, *A. albifrons*, and *A. ater*. They are about the size of a terrier dog, and have long prehensile tails.

ARCTOMYS, *ark'-to-mes.* (*See* MARMOT.)

ARCTOSTAPHYLOS, *ark-tos-taf'-i-los*, a genus of plants belonging to the natural order *Ericaceæ*. The species *A. uva-ursi*, the common bear-berry, is found wild in the mountainous parts of England and Scotland, and generally over the whole of Northern Europe. (*See* ARBUTUS.)

ARCTURUS, *ark-tu'-rus* (Gr., *arktos*, the bear, and *oura*, tail), a star of the first magnitude, in the constellation Boötes, or *Arctophylax*. The star is so called because it is situated near the tail of the Bear.

ARDEA. (*See* HERON.)

AREA, *air'-e-a*, denotes the same thing as superficies, or quantity of surface; but is applied exclusively to plane figures: thus, we say, the *surface* of a sphere, the *area* of a triangle. In Mathematics, the measuring unit of every area is the square described upon the measuring unit of length: thus, we speak of the square inches, square feet, or square miles which an area contains.

In Building, the open sunken space giving access to the basement of a house.

ARECA, *a-re'-ka*, a genus of plants belonging to the natural order *Palmaceæ*—the Palms, containing two species, each remarkable for the purposes to which it is applied. *A. catechu*—the Pinang, or betel-nut palm, has been described as the most beautiful palm in India. The stem is remarkably straight, and often from 40 to 50 feet high, and generally about 20 inches in circumference. It is cultivated throughout India for the sake of its seeds, which are known as betel, areca, and pinang nuts. The nut, about the size of a hen's egg, is one of the ingredients in the famed masticatory of the East called betel (which *see*). Charcoal prepared from the nuts, and termed areca-nut charcoal, is used in this country as a tooth-powder. An extract is made from the nuts in the south of India; and this constitutes one of the commercial varieties of catechu (which *see*). The timber and leaf-stalks are made use of for various purposes; and in Malabar an inebriating beverage is prepared from the sap. *A. oleracea*, the cabbage-palm, is a native of Jamaica and other West-India islands. The trunk, which is seldom more than six or seven inches in diameter, grows to a height of from 100 to 200 feet. This majestic palm is frequently cut down for the sake of the single terminal bud, called the cabbage, which is eaten either raw or boiled as a vegetable. The nuts, about the size of a filbert, are very abundant. *A. sapida*, the New Zealand palm, is a small tree, but grows farther south than any other palm. *A. vestiari*, an Asiatic palm is so named because clothing is made from its fibres.

ARENACEOUS ROCKS, *a-re-nai'-shus*, are those composed of grains of sand, or which contain sand in any notable degree, as grits and sandstones. Mica or feldspar is frequently found in these rocks. When the rock is coarse-grained, it is called *grit*; when the grains are as large as pebbles, *conglomerate* or *pudding-stone*; and when the fragments are sharp and angular, *breccia*.

ARENARIA, *a-ren-air'-re-a.* (*See* SANDWORT.)

ARENG. (*See* GOMUTO.)

ARENICOLITES, *ar'-en-i-ko-lites*, a term applied to circular holes or markings which have been observed on the upper surface of many sandstones, and which are supposed to have been worm-burrows, like those of the arenicola or lobworm.

AREOLA, *a-re'-o-la* (Lat., a small open space or circle, diminutive of *area*), a term applied to the small interstices of minute cellular or other tissues, through which the smallest vessels and nerves pass, and to the small red or brownish circle which surrounds the niples of females, or the ring which surrounds the pustule of small or cowpox.

ARGALI, *ar'-ga-li* (*Ovis Ammon*), a species of wild sheep inhabiting the mountains of Siberia, Kamschatka, and the higher regions of the Himalayas. The horns of the male of this species of wild sheep are about 4 feet in length and 14 inches in circumference at their triangular-shaped base. The name of the animal is Mongolian, and was adopted by the Russian naturalist Pallas. The

Rocky Mountain sheep, or big-horn, has also been termed the American argali. (*See* SHEEP.)

ARGAN, *ar-gan'*, a small, spiny, evergreen tree, *Argania sideroxylon*, of the natural order *Sapotaceæ*. It is a native of the southern parts of Morocca, and bears an egg-shaped fruit, full of a white milky juice. From this fruit an oil is extracted used by the Moors in cookery.

ARGEL, OR ARGHEL, *ar'-gel*, a plant of the natural order *Asclepiadaceæ*, a native of Arabia. The leaves are frequently used for the adulteration of senna.

ARGEMONE, *ar-gem'-one*, in Botany, a genus of plants belonging to the natural order *Papaveraceæ*, the Poppy family. *A. mexicana*, the Mexican or gamboge thistle, is an annual herbaceous plant, with large yellow flowers, and sessile, waved, and sinuated spiny leaves. It is a native of Mexico and the south parts of the United States, but is cultivated in England and other parts of Europe as an ornamental plant. The seeds possess narcotic and purgative properties, and an oil is obtained from them which has been recommended as a remedy for cholera. In the West Indies the seeds are used as a substitute for ipecacuanha and opium, and the juice of the plant as a remedy for ophthalmia.

ARGENTIFEROUS, *ar-jen-tif'-e-rus*, silver-bearing. Applied to minerals, veins, or metals containing silver.

ARGENTITE, *ar'-jen-tite*, one of the most important ores of silver. It is occasionally found in crystals, but more frequently in malleable blackish lead-coloured masses. It is found in granite and porphyry, in different parts of the world, and consists of 86 parts of silver to 14 of sulphur.

ARGENTINE, *ar'-jen-tine*, a genus of small fishes of the family *Salmonidæ*, found chiefly in the Mediterranean, and occasionally in the British sea. They are remarkable for their silvery lustre, and the air bladder is covered with *nacra*, a coat of silvery fibres, used in making artificial pearls.

ARGES, *ar'-ges*, a genus of small fishes of the family *Siluridæ*, remarkable as being ejected in vast numbers by some of the South American volcanoes. It is supposed that they exist in lakes within the cavernous recesses of the mountains. Several species are known, to which the natives of the region give the name of *preñadittas*.

ARGILE PLASTIQUE, *ar'-zheel plas-teek'* (Fr., plastic clay), the term applied to extensive deposits of sand, with occasional beds of clay, used for pottery, near the base of the tertiary system in France. (*See* EOCENE.)

ARGILLACEOUS ROCKS, *ar-jil'-lai'-she-us* (Lat., *argilla*, clay), are those composed of clay, or having a notable proportion of clay in their composition, as roofing-slate and shale. All such rocks emit a peculiar odour when breathed upon. (*See* CLAY and CLAY SLATE.)

ARGO, OR ARGO NAVIS, *ar'-go*, the ship *Argo*, a constellation, the greater part of which lies in the southern hemisphere. It is of considerable extent, and is divided by astronomers into four parts or regions.

ARGONAUTA. (*See* PAPER NAUTILUS.)

ARGUMENT, in Astronomy, a quantity upon which an equation of other circumstance relating to the motion of a planet depends.

ARGUS PHEASANT, *ar'-gus* (*Argus giganteus*), a rare and beautiful bird, native of many parts of the Indian Archipelago, the peninsula of Malacca, and Siam, and said to exist in some parts of northern China. The tail of the adult male is nearly 4 feet long, and the plumage is wonderfully varied and elegant.

ARIADNE, *ar-i-ad'-ne*, one of the asteroids, or group of small planets, revolving between Mars and Jupiter. (*See* ASTEROIDS.) It is the forty-third in order of discovery, and was first noticed by Mr. Pogson, at Oxford, April 15, 1857.

ARIES, *air'-i-ees* (Lat., a ram), the first of the twelve signs of the zodiac, and a constellation giving its name to a space of 30° of the ecliptic, which the sun enters in March, measured from the vernal equinox. Owing to the constant change of the position of the vernal equinox, arising from the precession of the equinoxes, the sign Aries no longer corresponds with the constellation of that name, but has moved about 30° to the westward of it.

ARILLUS, *a-ril'-lus*, the term applied to an integument which is occasionally found covering, wholly or partially, the *testa*, or outer coat of a seed. The seed of the Passion-flower exhibits this covering, which commences at the base and proceeds towards the apex. In the nutmeg, the additional coat proceeds from above downwards, and constitutes the substance called mace, which is extensively employed as a spice.

ARISÆMA, *ar-i-se'-ma*, a genus of plants belonging to the natural order *Araceæ*, the Arum family. The species *A. atrorubeus*, Dragon-root, or Indian Turnip, is a native of North America. From the tuber a nutritious fecula is obtained. In medicine, the tuber is also occasionally used, being given internally as a stimulant in rheumatism and bronchial diseases, and being also employed as an application to apthous affections in children.

ARISTOLOCHIACEÆ, *a-ris'-to-lo-ki-ai'-se-e*, a natural order of plants of the class *Dicotyledones*, sub-class *Monoclamydeæ*, consisting of herbs or shrubby climbers, which are sparingly distributed in several parts of the world, but are very common in the tropical portion of South America. There are nine genera and 130 species. The typical genus *Aristolochia clematitis*, Birthwort, is distinguished by a tubular oblique perianth, generally inflated at the base, the mouth dilated on one side, and by stamens adherent to the style. Several species of this genus have been employed in medicine, principally on account of their supposed properties for regulating certain functions; and hence the name Birthwort. The roots of *A. longa*, *A. rotunda*, and *A. clematitis* are most commonly used. They have all stimulant and tonic properties. *A. anguicida* is supposed by Lindley to be the celebrated guaco of the Columbians. The juice of the root is said to stupefy snakes, so that they may be handled and played with. *A. serpentaria*, commonly called serpentary, or Virginian snake-root, was originally introduced as an antidote to snake bites, but it is now known that it has no efficacy in such cases. It is a valuable stimulant, tonic, and diaphoretic, and is especially useful in fevers of a low or typhoid character. The roots of *A. reticulata*, *A. tomentosa*, and *A. hastata* are said to be mixed in commerce with those of *A. serpentaria*. Several species of this important genus are cultivated in hothouses as ornamental plants.

ARISTOTELIA, *ar-is-to-te'-li-a*, a genus of plants belonging to the natural order *Tiliaceæ*, the lime-tree or Linden family. The most important species is *A. Maqui*, which produces an edible fruit, from which a kind of wine is prepared.

ARITHMETIC, *a-rith'-me-tik* (Gr., *arithmetike*, derived from *arithmos*), the science of numbers, or that portion of mathematics concerned with the properties of numbers. Every number is a ratio or relation; that is to say, every magnitude, compared with another magnitude, is either equal, or greater, or less, and, therefore, has a certain relation to that with which it is compared. Arithmetic is the art of combining these relations with one another, using for the purpose the signs themselves, by which the numbers are distinguished; thus, the four operations of addition, subtraction, multiplication, and division, include the entire science. For the facilitating of calculations and for commercial purposes, other useful rules have been invented; such as proportion, interest, discount, decimals, extraction of roots, &c.; but they are but different applications of the four elementary rules. The precise epoch in which numerical signs and the first methods of computation and calculation were discovered, is enveloped in mystery; but there can be little doubt that the decimal system, or method of calculation by tens, originated from the custom of children reckoning by the fingers. It was not till the commencement of the 13th century that the science of arithmetic became disseminated in Europe. The employment of the Arabic or Indian numerals, and the facilities afforded by algebra, have been the chief causes of the immense progress and development of modern mathematical calculations. (*See* ALGEBRA, DECIMALS, DUODECIMALS, and the various rules of arithmetic under their proper headings.)

Arithmetical Mean is that number which lies equally distant between two others, and is found by taking half their sum; thus the arithmetical mean between 10 and 16 is 13.

Arithmetical Progression. (*See* PROGRESSION.)

Arithmetical Signs, arbitrary marks or symbols to denote the operations to be performed on numbers. The same signs (+, −, =, &c.) are used in Algebra. (*See* ALGEBRA.)

ARM, *arm* (Lat., *brachium*), is that part of the upper extremity of the body which extends from the shoulder to the wrist. It consists of two portions—the arm, or *brachium*, properly so called, and the fore-arm, or *anti-brachium*; the former having one bone—the humerus; the latter two bones—the radius and ulna. (*See* ANATOMY.)

ARMADILLO, *ar-ma-dil'-lo* (*Dasypus*), a genus of mammiferous quadrupeds of the order *Edentata*, intermediate between the sloths and ant-eaters, and characterized by the possession of molar teeth only. Instead of hair, the armadillos are covered with a species of hard bony crust, forming three bucklers, on the rump, shoulder, and head, respectively; the two latter being connected by a number of transverse movable bands, very similar in form and appearance to the plate-armour of the Middle Ages, from which, indeed, these animals have acquired their name of armadillos—a name of Spanish origin, and adopted by English writers. The anterior surface of the body, not covered by the buckler, is clothed with coarse scattered hairs, of which some are also seen to issue forth between the joints of the armour. It has rather a pointed snout, long ears, short and thick limbs, and stout claws, which are in every respect adapted for digging and burrowing. So rapid, indeed, do the armadillos perform this operation, that they easily bury themselves in the earth beyond the reach of the hunter, who has no other resource but to smoke out his obstinate game. Once brought to the surface, however, the animal becomes an easy prey, as its only defence is to roll itself up hedgehog-wise, and await an assault. They are, however, by no means easily unkennelled, and have been known to allow a hunter to hack their tails off while they held on in the depths of their burrow by their powerful claws. The animal never attempts to bite any one by whom it is attacked. Its food consists of roots, fallen fruits, worms, and carrion if it can be obtained. The tropical and temperate regions of South America are the original and proper habitation of all the known species of the armadillo.

Crustacea.—Armadillo is the scientific name of a small animal of this genus, popularly known as the woodlouse, or fell-beetle, from its power of rolling itself into a ball when threatened.

ARMERIA, *ar-meer'-i-a*, a genus of plants belonging to the natural order *Plumbaginaceæ*. Thrift is the common English name for this genus. The dried flowers of the common thrift, *A. vulgaris*, are diuretic.

ARMILLARY SPHERE, *ar-mil'-la-re* (Lat., *armilla*, a bracelet), an instrument representing the great circles of the celestial sphere, the equator, ecliptic, tropics, equinoctial colure, &c. It is constructed of rings of metal, representing those circles, fastened together in their relative positions, and movable on an axis passing through the poles: it is furnished with a horizon and meridian similar to those attached to the terrestrial and the celestial globes. It was formerly much used by the early astronomers, but is now superseded by the celestial globe. The earth on which the observer stands is supposed to be in the centre of this skeleton sphere, the rings representing the imaginary circles above named, traced on the apparent sphere of the heavens around him, by which the position of any star may be determined. (*See* ASTROLABE.)

ARMORACIA, *ar-mo-rai'-si-a*, a genus of plants belonging to the natural order *Cruciferæ*. The species *A. rusticana* is cultivated for the sake of the root, which is the common *horse-radish*, so much used as a condiment. (*See* HORSE-RADISH.)

ARNEE, *ar-ne'* (*Bos Arnee*) an animal of the highlands of Hindostan, closely allied to the common wild buffalo. It is the largest animal of the ox kind known, and remarkable for strength and courage, qualities admirably seconded by a pair of horns measuring from four to six feet in length, and arching in the form of a bold crescent. In Bengal this animal is known as *Arria*.

ARNICA, *ar'-ni-ka*, a genus of plants belonging to the natural order *Compositæ*. The most important species is *A. montana*, known by the names of Mountain-tobacco, and German Leopard-bane. It is a perennial herbaceous plant, found growing in the meadows of the cooler parts of Europe, and also of the western states of North America. The florets are of a yellow colour, tinged with brown. The whole plant, when fresh, possesses a strong and disagreeable odour and an acrid, bitter taste. The plant has striking medicinal properties. The preparation known as tincture of Arnica, which is obtained by macerating the flowers with alcohol, is now largely employed as an external application for bruises. The flowers have been occasionally employed as a substitute for Peruvian bark, and are said to have proved beneficial in cases of amaurosis and chronic rheumatism. Preparations of arnica are much used by homœopathists.

ARNOTTO. (*See* ANNATTO.)

AROMA, *a-ro'-ma* (Gr., pleasant perfume), the principle in plants or other substances which constitutes their fragrance. In some plants this resides in a volatile oil; but in others the portion containing this principle cannot be detected.

ARRACACHA, *ar-ra-ka'-ka*, a genus of plants belonging to the natural order *Umbelliferæ*. It includes one species of great importance, namely, *A. esculenta*, a plant much cultivated in the tropical regions of South America for the sake of the root, which is a valuable article of food. This is about the size of a parsnip, which it somewhat resembles in flavour. The starch obtained by rasping and washing the root is similar to arrowroot.

ARROWHEAD, a genus of aquatic plants. (*See* SAGITTARIA.)

ARRHENATHERUM, *ar'-hen-a-the'-rum* (Gr., *arrhen*, mole, and *ather*, awn, or hairy pointed beard of corn or other grasses), a genus of grasses, of which the *A. avenaceum*, a common grass in Britain, sometimes known as oatlike-grass, is a familiar specimen.

ARTANTHE, *ar-tan-the*, a genus of plants belonging to the natural order *Piperaceæ*. The species are natives of the tropical regions of America. The dried leaves of *A. elongata* are much used in medicine. (*See* MATICO.) The dried fruits of *A. adunca* are employed as a substitute for pepper. The spikes of fruit of *A. crocata* are used for dyeing yellow.

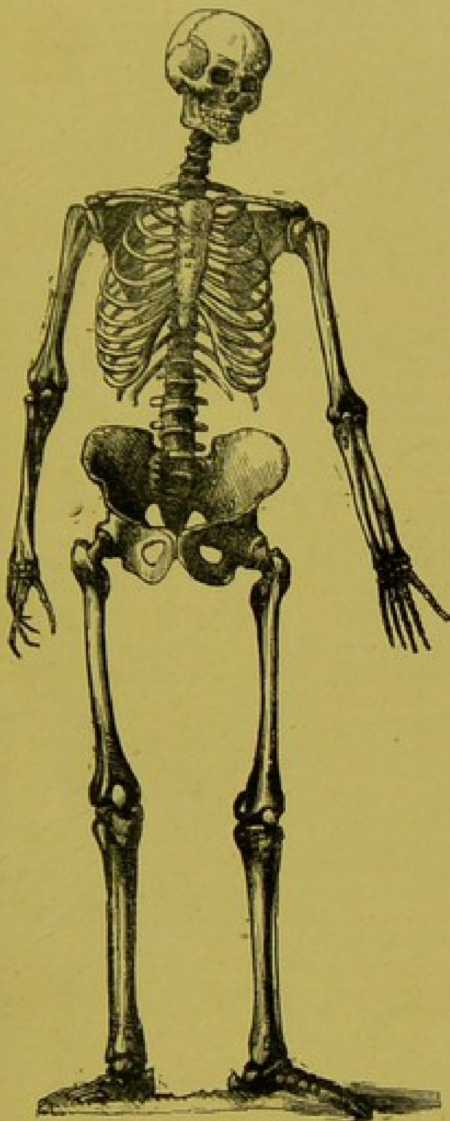
ARTEMISIA, *ar-te-mis'-i-a* (from *Artemis*, one of the names of the goddess Diana), a genus of plants belonging to the natural order *Compositæ*, sub-order *Corymbiferæ*, and comprehending several interesting and valuable species. *A. absinthium*, the common wormwood, is an indigenous perennial, often met with in waste places and by roadsides. The flowers are arranged in globular heads, and are of a buff or yellowish colour, blossoming in August. The principal constituents are a volatile oil, a bitter principle called absinthin, and carbonate of potash. The latter was formerly known as "salt of wormwood;" but it possesses no specific virtue other than belongs to carbonate of potash generally: it is still, however, regarded as a patent remedial agent by the ignorant. The dried herb, or flowering-top, under the name of wormwood, is used as an aromatic bitter tonic, and as an anthelmintic. It is also employed in the preparation of liqueurs. The species *A. abrotanum* is the familiar southernwood, a fragrant plant employed on the Continent in making beer. The Persian species *A. acetica* is said to have the odour of strong vinegar; hence its name. The species *A. alba* and others are said to serve as nourishment to the herds of the Kirghese and Calmucs. The anthelmintic known by the names Semen-seriphii and Barbotine consists of the flower-heads of *A. cœrulescens*, a Mediterranean plant. *A. chinensis*, and other species, are stated by Lindley to yield the Moxa of China. It is prepared from the cottony or woolly covering of the leaves, and used as a cautery, by burning it upon parts affected with gout and rheumatism. (*See* MOXA.) *A. dracunculus* is the tarragon, the leaves of which are used for flavouring vinegar in pickles and salads. *A. gallica*, termed in France sanguerie or sanguerite, possesses similar properties to the species *cœrulescens*. *A. indica* and *madraspatana*, both Indian species, are much used by the native doctors. *A. mutellina* and *spicata*, both Alpine plants, are said to furnish between them the famous liquor called *crême d'absinthe*, which a modern French writer styles "the emerald poison." The substance sold as wormseed, and known under the names of semen-contra, semen-cinæ, and semen-santonicum, consists of the broken flower-stalks, involucres, and flower-buds of *A. contra*, *pauciflora*, *lercheana*, *sieberi*, and *valiana*. It is employed as a vermifuge.

ARTERY, *ar'-te-re* (Gr., *aer*, air, and *tereo*, I keep), is literally an air-duct, and was a name applied by the ancients to certain vessels of the human body, which were believed by them to contain air, from their being found empty after death. The arteries are those vessels which convey the blood from the heart to all parts of the system. They are membraneous cylindrical tubes, composed of three coats; viz., the external, which is firm, strong, and elastic; the middle, which is muscular, contractile, and brittle; and the internal, which is brittle, smooth, and transparent, and lined with epithelium on the side washed by the blood. The action of the arteries called the pulse corresponds with that of the heart, and is effected by the contraction of their muscular coat and the great elasticity of their outermost one. Besides the arteries which carry the purified blood from the heart to all parts of the body, there is the pulmonary artery, which emerges from the right ventricle of the heart, and carries the impure blood from the heart to the lungs. The other arteries all spring from the aorta. (*See* ANATOMY.) The principal arteries will be found noticed under their respective names.

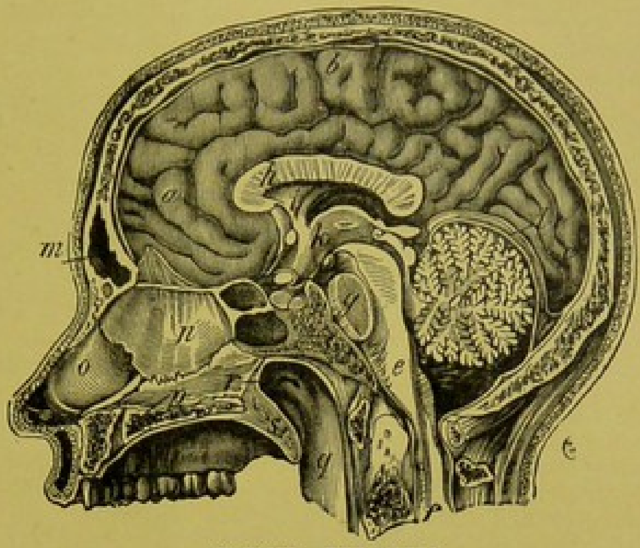
ARTHRON, *arth'-ron*, is a Greek word signifying a joint, and, in composition, is used in a number of medical terms; as, *arthrosis*, an articulation; *arthritis*, inflammation of a joint, the gout; *arthrodynia*, pain in a joint; *arthropuosis*, a collection of pus in a joint; *arthrodia*, a species of articulation, in which the head of one bone is received into the superficial cavity of another, so as to admit of motion in every direction.

ARTHRODIC, *ar-thro'-dik* (Gr., *arthrosis*, articulation), in Anatomy, a term applied to a connection of bones, in which the head of one fits into a shallow cavity in another; by which means motion in nearly every direction is admitted of; as, for example, in the joint between the humerus and the scapula.

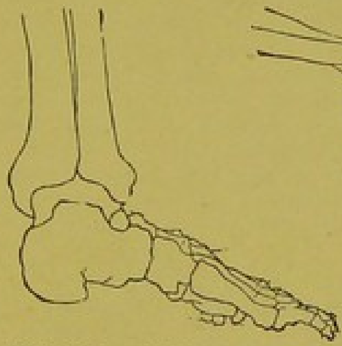
ARTHRODIEÆ, *ar-thro-di'-ee* (Gr., *arthron*, a joint), a term applied to such algæ as possess an articulated structure, like *Conferva* and *Oscillatorias*.



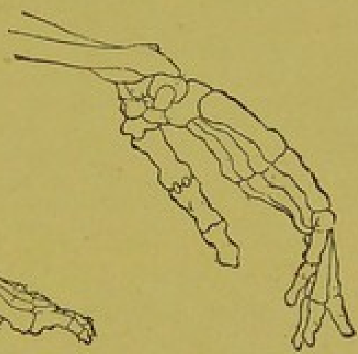
ANATOMY.—THE HUMAN SKELETON.



ANATOMY.—THE SKULL.



ANATOMY.—BONES OF THE FOOT.



THE HAND.

ARGUS PHEASANT.

ANTEATER.

ARTICHOKE, *ar'-ti-choke* (Fr., *artichaut*). This esculent is the young succulent receptacle of the flower-head of *Cynara Scolymus*, a perennial plant growing wild in the south of Europe, and extensively cultivated in this country. On the Continent, the artichoke is frequently eaten raw with salt, pepper, and oil; but in England it is generally boiled before it is sent to the table. (*See* CYNARA.) The esculent tubers of a species of sunflower, *Helianthus tuberosum*, are known as Jerusalem artichokes; the term Jerusalem being a corruption of the Italian *girasole*, "sunflower." (*See* HELIANTHUS.)

ARTICULATA, OR ARTICULATED ANIMALS, *ar-tik-u-lai'-ta* (Latin, *articulatus*, jointed), according to the classification of Cuvier, the third great division of the animal kingdom. Arthropoda is the designation now generally adopted. (*See* ARTHROPODA.)

ARTICULATION, *ar-tik'-a-la-shun*, in Anatomy, the connection of the bones of the skeleton by joints. (*See* ANATOMY.)

ARTOCARPACEÆ, *ar'-to-kar-pai'-se-e* (Gr., *artos*, bread, *karpos*, fruit), a natural order of dicotyledonous plants, consisting of 30 genera and about 60 species—trees or shrubs, found only in tropical regions, having a milky juice, which contains caoutchouc, or India-rubber, dense heads of unisexual flowers, and, generally, fruits of the sorosis form. The typical genus, *Artocarpus*, or bread-fruit, includes two very important food-producing trees, namely, *A. incisa* and *A. integrifolia*. The first species is a native of the Moluccas and islands of the Pacific; it yields the nutritious bread-fruit which supplies the place of corn to the natives of the regions in which it flourishes. The milky juice of some species yields CAOUTCHOUC, and from one, popularly known as the Cow-tree, a substitute for milk is obtained. The species *A. integrifolia* yields the Jak, or Jack-fruit, which is largely used as food in Ceylon and some other parts of the East. (*See* SOROSIS.) The natural order *Artocarpaceæ* includes other interesting genera, which are noticed under the botanical names. (*See* ANTIARIS, BROSIMUM, PHYTOCRENE.)

ARUM, *air'-um* (formerly *aron*, supposed to be an ancient Egyptian word), the typical genus of natural order *Araceæ*. The only British species is *A. maculatum*, the common cuckoo-pint, wake-robin, or lords-and-ladies, and probably the long purples of Shakspeare. This curious perennial is found growing in shady places, hedge-banks, rough grounds, and groves. The flowers, which come to perfection in April and May, are monœcious; that is, the sexes are contained in different flowers on the same plant. They are arranged on a succulent axis, terminating in a club-shaped receptacle termed a spadix, of a purple or yellowish-white colour, and inclosed in a membranous sheath denominated a spathe. The berries are of a fine scarlet colour, and help to adorn our hedges in autumn. They are very poisonous, and the whole plant contains acrid and poisonous juices. The tubers, which are filled with starch, are dried, powdered, and used in France as a cosmetic, under the name of cypress powder. The starch, separated from acrid juices, forms Portland arrowroot, which was formerly prepared in large quantities in the island of Portland, where the plant grows in great profusion. In the fresh state, the tubers are stimulant, diaphoretic, and expectorant, and were formerly used in the form of an emulsion in obstinate rheumatism.

ARUNDO, *a-run'-do* (probably Lat., *arundo*, reed, or from Celtic *aru*, water), a genus of grasses, the species of which frequently attain a considerable size, and are found in many climates. *A. phragmites*, the common reed, is a well-known species, the culms being largely employed for thatching and other useful purposes.

ARYAN RACE, *a'-re-an* (Sanscrit, "honourable"), the name generally given by ethnologists to that division of mankind otherwise called Indo-European or Indo-Germanic. The first traces of the race are found in Central Asia, eastward of the Caspian Sea, and north of the Hindoo-Koosh mountains. From this centre migrations took place, probably impelled by the necessity arising from increased numbers, the movement beginning about two thousand years before the Christian era. Large numbers moved towards the north-west, probably reaching Europe; others crossed the Indus and penetrated into the great peninsula of Southern Asia. The three higher castes of India still claim to be of Aryan descent, as superior to the lower or subjugated castes, the Sudras, and the third caste is specially named Aryan. From India, the Aryans reached Persia, and others settled in Asia Minor, from which a further migration took place to Southern and Central Europe. In the Veds the sacred books of the Hindoos, Arya is the name by which the believers in the gods are distinguished from their enemies, who are called Dasas. Iran, the old name assumed by the dominant races of Persia, is evidently derived from the same root. In the Persian cuneiform inscriptions, Darius claims, with apparent pride, that he was of Aryan descent.

ASAFŒTIDA, OR ASSAFŒTIDA, *as-sa-fe'-ti-da* (Persian, *asa*; Lat., *fœtidus*, fetid), the name of a fetid gum-resin, used in medicine on account of its anti-spasmodic and more or less stimulating properties, and extensively employed in Persia and the adjacent countries as a condiment, just as garlic and other allied plants are employed in Europe. The umbelliferous plant *Narthex*, or *Ferula asafœtida*, yields the greater part of the asafœtida of commerce. The peculiar, and, to Europeans, offensive odour of asafœtida, is attributed to the presence of sulphur in combination with allyle. (*See* ALLYLE.)

ASAGRÆA, *as-a-gre'-a*, a genus of plants belonging to the natural order *Melanthoceæ* or *Colchicaceæ*. The most important species is *A. officinalis*, a native of Mexico, and the principal, if not the only source of the *Sabadilla*, *Cevadilla*, or *Cabadilla* of the shops, which consists of the fruits and seeds. The seeds yield any alkaloid, which has been used externally as a remedy for rheumatism, gout, and neuralgic affections, and also internally in similar cases, in doses of one-twelfth to one-sixth of a grain. It is a most powerful poison. Sabadilla seeds, when powdered and applied externally, destroy vermin.

ASAPHUS, *as'-a-fus* (Gr., *asaphes*, obscure), in Geology, a genus of trilobites. (*See* TRILOBITE.)

ASARABACCA. (*See* ASARUM.)

ASARUM, *as'-a-rum* (Gr., *a*, not, *saron*, feminine), a genus of plants belonging to the natural order *Aristolochiaceæ*. The species *A. europæum*, a native of Europe, is a rare plant in the woods of Britain. The root which forms the drug asarabacca contains a camphor-like principle, and a bitter principle called *asarin*, which is combined with gallic acid. It was formerly much employed as an emetic; but has been superseded by ipecacuanha, which is milder and safer. It is still occasionally used as an errhine—that is, a medicine to be snuffed up the nose in headache and ophthalmia. The species *A. canadense*, the Canada snake-root, or wild ginger, is another medicinal plant, the rhizome being used in the United States as a tonic, diaphoretic, and aromatic stimulant.

ASBESTOS, OR ASBESTUS, *as-bes'-tos* (Gr., *asbestos*, incombustible), a fibrous variety of hornblende, so soft that it can be spun and woven into fabrics. It is remarkable for being incombustible; and for this reason it was used by the ancients for wrapping up their dead before placing them on the funeral pile, in order that none of their ashes might be lost. They also used it for napkins, which, when soiled, were passed through the fire. They likewise used it for lamp wicks, composed chiefly of silica, magnesia, alumina, and ferrous oxide. The finest variety is known as Amianthus, from a Greek word signifying "unpolluted." It is very plentiful in Corsica, and is found also in Savoy, Scotland, the Shetland Islands, and many other places. Common asbestos, inferior in quality, is found in serpentine rocks; and other varieties of small value are known as mountain leather, mountain cork, and mountain wood. The latter melts before the blowpipe. Fireproof cloth has been woven from asbestos fibre, but its feeble consistency is an objection to its use for that purpose. Paper has also been made from it, and it was supposed that it would be invaluable for the preservation of important documents in case of fire, but it was found that, although flames could not destroy the paper, they effectually obliterated the writing. More practical use is made of the fibre as a packing for fireproof safes and pistons of steam engines.

ASCARIDES, OR ASCARIS, *as-kar'-i-dees* (Gr., *askarizo*, I jump), parasitic worms which inhabit the intestines of animals. They belong to the genus *Entozoa*, and are ranked in the order *Nematoidoa*. One of the commonest species, the *A. lumbricoides*, which is very like the common earthworm, is found frequently in the intestines of men, and of horses, oxen, &c. They have been observed fifteen inches in length, and they are often the cause of severe disease, which has sometimes proved fatal. The mouth of this worm is only formed for suction; hence it is unable to injure the coating of healthy intestines. In a very young state, ascarides have never been found either in man or the other animals. Persons living in damp valleys are said to be most liable to suffer from them. The *A. vermicularis*, or threadworm, is very common among young children. It is white, and about half-an-inch long. It infests the lower part of the intestines in great numbers, causing much irritation. Though so small, it possesses a highly developed nervous system. (*See* VERMIFUGE, THREADWORM.)

ASCENSION, RIGHT, *as-sen'-shun* (Lat., *ascensio*, a rising, a term in Astronomy. The right ascension of any heavenly body is the arc of the celestial equator intercepted between the first point of Aries and the meridian, or circle of declination passing through the object, or the distance east from the meridian, passing through the first point of Aries measured on the equinoctial or celestial equator. It corresponds with longitude on the terrestrial globe; and as the position of any place on the earth is determined by its longitude and latitude, so the position of any object in the heavens is determined by its right ascension and declination. (*See* DECLINATION.) The right ascension of any heavenly body is ascertained by the aid of a transit-instrument and sidereal clock, the former showing its passage across the meridian, and the latter indicating the time when the passage takes place. The sidereal clock beats seconds, and is so constructed and regulated, that the hour hand describes a complete revolution in 24 hours from the time of the passage of any star across the meridian to its return to the same point.

Oblique ascension is the arc of the celestial equator intercepted between the first point of Aries and that point of the equator which rises at the same time with any heavenly body.

Ascensional difference is the difference between the right and oblique ascension of any object.

ASCIANS, *ash'-i-ans* (Gr., *a*, not, and *skia*, shadow), a term applied to those inhabitants of the globe who at certain times of the year have no shadow. Such are the inhabitants of the torrid zone, where the sun being twice a year in its zenith,—in other words, being vertically above their heads,—no projecting shadow is thrown.

ASCIDIANS, *as-sid'-i-ans* (Gr., bottle-shaped, from *askos*, a leather bottle), a term usually employed to distinguish a genus of molluscan animals, found in all seas. The type of the family *Ascidiadæ*. They are acephalous; that is, without heads, and are encased in a kind of elastic tunic, inclosing a second mantle or tunic, which is muscular, and adheres to the first only near two orifices. Their nature is very apathetic, and they remain fixed to a rock or a piece of seaweed, living upon the animalculæ which are drawn in with the water that is constantly passing through their ciliated respiratory organs. The action of the *cilia* seems to be involuntary. The sexes of ascidians are distinct; and their chief nervous centre is situated between the openings of the muscular tunic. In 1828 MM. Milne-Edwards and Audouin discovered that an ascidian does not begin life as a fixed animal, but was able to move about like tadpoles, by means of a vibrating tail. After a time it attaches itself to a plant or rock, and the tail disappears. Many of the ascidians are splendidly coloured, and often cling about seaweed like bunches of strange fruit. They are divided into two classes—compound and solitary ascidians. (*See* POLYPE, ZOOPHYTE.)

ASCITES, *as-si'-tees* (Gr., *askites*, from *askos*, a bottle), a term employed to denote abdominal dropsy, or dropsy in the belly. (*See* DROPSY.)

ASCLEPIADACEÆ, OR ASCLEPIADEÆ, *as-kle-pi-a-dai'-se-e*, the *Asclepias* or Milk-weed order of dicotyledonous plants, included in the sub-class *Corolliflorœ*—shrubs or trees commonly lactescent, and frequently with twining stems. The order is at once distinguished by a curiously-formed five-cornered stigma, and by the grains of pollen cohering in wax-like masses, which, when the anther dehisces, become attached to glands at the angles of the stigma. There are

157 genera and about 930 species, which are mostly tropical, abounding in South Africa, India, and equinoctial America. Some are cultivated in British gardens and hothouses for the sake of the beautiful or curious flowers they bear. (*See* ASCLEPIAS, CALOTROPIS, CYNANCHUM, HEMIDESMUS, GYMNEMA, and MARSDENIA.)

ASCLEPIAS, *as-kle'-pi-as* (Gr., name of Æsculapius, the god of medicine), a genus of plants, the type of the natural order *Asclepiadaceæ*. The common English name for the genus is Swallow-wort. The species are mostly American, and many of them possess powerful medicinal qualities, as one might expect from the generic name. They are herbaceous plants, seldom of a twining habit, with opposite, whorled, or alternate leaves, and flowers arranged in simple umbels between the leaf-stalks. The corolla is five-parted and reflexed. The stamens, five in number, alternate with the lobes of the corolla, and have curious horn-like appendages. The species *A. syriaca*, Syrian or Virginian swallow-wort, was formerly thought to be a native of Syria, but is now regarded as an American plant. The white acrid juice of this plant contains caoutchouc. The seeds are covered with down, which is frequently employed in America for making wadding and for stuffing pillows and mattresses. The stalks furnish a very tough fibre, which is used for the manufacture of thread, cloth, ropes, and nets. Sugar has been prepared from the flowers. *A. curassavica*, the bastard ipecacuanha, is another important species. It is a native of the West-Indian islands, where the root is employed by the negroes as an emetic, and is occasionally sent to England as ipecacuanha. From the stems of *A. tenacissima* the Jetee or Tongoose fibres are obtained. The root of *A. tuberosa* is sometimes used as a diaphoretic and expectorant. The last-named plant, which is commonly known as the butter-fly weed or pleurisy-root, is frequently cultivated as an ornamental garden flower. In Arabia the young shoots of *A. stipitaceæ* are eaten like asparagus.

ASH, (Ger., *esche*,) a genus of trees belonging to the natural order *oleaceæ*. The botanical name is *Fraxinus*. There are about fifty species, mostly natives of Europe and North America. The leaves are deciduous, and are pinnate, with a terminal leaflet. The flowers are very imperfect, the calyx being obsolete, and the corolla either wanting or 3—4-partite. The fruit is a *samara* (which *see*). *F. excelsior*, the common ash, a native of Britain, is a beautiful and umbrageous tree, rising to the height of 100 to 150 feet. The wood is white, tough, hard, and light, much valued by wheelwrights, coachmakers, and turners. It is peculiarly adapted for agricultural implements, handles for tools, and ladders. Sometimes it is irregular in the disposition of its fibres and finely veined, and is then prized by cabinet-makers. Some interesting varieties have been developed by cultivation: the weeping ash, with branches drooping to the ground; the curled-leaved ash, with dark green wrinkled or curled leaves; and the entire-leaved ash, with many or all the leaves simple. *F. americana*, the American or white ash is a very fine tree, common in Canada and New Brunswick, with wood similar to that of *F. excelsior*. The sweet concrete exudation known as *manna* is procured by making incisions in the stems of certain species of *Fraxinus*, chiefly *F. ornus* and *rotundifolia*, natives of Calabria, Apulia, and Sicily. Manna is a mild agreeable laxative. It owes its properties to a peculiar resin called mannite. The insect which produces the white wax of China feeds upon the species *F. chinensis*. The mountain ash belongs to a different natural order. (*See* ROWAN.)

ASOCA, *a-so'-ka*, an Indian tree (*Jonesia asoca*) of the natural order *Leguminosæ* sub-order *Cæsalpineæa*, remarkable for the beauty of its red and orange flowers. It is often mentioned in Indian poetry, and figures in the Hindoo mythology.

ASP, *asp* (Lat. *aspis*), a name confined by naturalists to the *Vipera aspis*, a venomous snake peculiar to the European Alps, but commonly applied to several species of poisonous serpents. The asp is often mentioned by both Greek and Roman writers; but the most common and celebrated would seem to be that called by the Arabs Haje Nasher. This animal measures from three to five feet in length, is of a dark green colour, marked obliquely with bands of brown. The haje is closely allied to the cobra di capello, or spectacled snake of India. Old writers give the name to several kinds of poisonous snakes; and the asp by which Cleopatra is said to have ended her life is generally supposed to have been the cerastes, or horned viper, a much smaller snake. The asp, four times mentioned in the Old Testament is generally considered to be synonymous with adder.

ASPARAGUS, *as-par'-a-gus*, a genus of plants belonging to the natural order *Liliaceæ*, the Lily family. The species are herbaceous, or shrubby plants, growing wild in the southern parts of Europe and in Africa. *A. officinalis*, the common asparagus, has long been cultivated for the sake of the young succulent shoots, which form a much esteemed article of food, on account of its delicate flavour. There are many local varieties of asparagus, but they may all be regarded as slight modifications of two well-marked sorts, namely, the red-topped and the green-topped. In the kitchen-garden asparagus is generally grown in beds four feet broad, and in rows a foot or eighteen inches apart, with the space of nine inches between every two plants in the rows. The plants are either raised from seed where they are to remain, or raised on a seed-bed the preceding year, and transplanted. The value of the crop depends on the soil being dry, sandy, well trenched, and powerfully manured. The trenches should be from two and a half to three feet deep. Asparagus-shoots contain a peculiar crystalline principle, to which the name *asparagin* has been given: this has a specific action on the urinary organs, and its properties have caused asparagus to be popularly employed as a lithic; but it is a somewhat dangerous remedy, and is now obsolete. The shoots, roots, and flowering stems of *A. officinalis* are, however, occasionally employed as diuretics. The roasted seeds have been used as a substitute for coffee. The young shoots of the species *A. tenuifolius*, *A. acutifolius*, and especially *A. albus*, are eaten in the south of Europe. Under the name of Prussian asparagus, the spikes of an allied plant, *ornithogalum pyrenaicum*, are sometimes used.

ASPECTS, *as'-pects*, in Astronomy, certain positions of planets with respect to one another as seen from the earth. Astrology ascribed to these aspects great influence over the destinies of individuals and nations.

ASPEN, *as'-pen*, the trembling-leaved poplar (*Populus tremula*), a tree, a native of northern Europe and Asia, found sometimes in Scotland, at a considerable elevation above the sea; and in favourable moist soils reaching a height of 80 to 90 feet, but in other places dwarfish. The name is derived from the almost continued movements of the leaves, suspended by flattened leaf-stalks. The wood is soft, light, and porous, readily worked at the turning lathe, and well adapted for arrows. In France, sabots are made of it. Charcoal made from the wood is used in the manufacture of gunpowder; and, in some parts of Europe, cattle, sheep, and goats are fed on the leaves. There are trees of a similar species in North America. (*See* POPLAR.)

ASPERGILLUM, *as-per-gil'-lum* (Latin, *aspergo*, to sprinkle, a genus of conchiferous mollusca, in which the shell has the form of an elongated cone, terminating at the larger end in a disc, with numerous small tubular holes, from which the popular name, the watery-pot, originated. A remarkable feature in the structure of the shelly tube is the presence of two rudimentary valves, which are in themselves useless, but show an affinity with mollusca inhabiting bivalve shells.

ASPERGILLUS, a genus of plants, containing many of the small fungi, commonly known as mould, which appears in decaying vegetable and animal substances.

ASPERULA, *as-pe-ru'-la* (diminutive of Lat., *asper*, rough), a genus of plants belonging to the natural order *Galiaceæ*, the Madder family. The species *A. adorata*, the woodruff, is one of the most fragrant plants found in our woods: it contains the natural perfume to which chemists have given the name of *coumarin*. *A. cynanchicha*, another indigenous species, is commonly called quinsey-wort, on account of its supposed value as a remedy in sore throat.

ASPHODE, *as-fo-de* (Gr., *a*, not, and *sphallo*, I supplant), a genus of plants belonging to the natural order *Liliaceæ*, the Lily family. It includes several beautiful perennials, with fleshy finger-like roots and upright annual stems covered with long leaves. The yellow and white asphodels, *A. luteus* and *A. albus*, have long been cultivated in Britain as garden-flowers. Immense tracts of land in Apulia are covered with the latter species, which affords good nourishment to the sheep. In ancient days it was sacred to Proserpine, and used in funeral ceremonies.

ASPHYXIA, *as-fix'-ia* (Gr., *a*, not, and *sphuxis*, pulsation), literally signifies cessation of pulsation, and is used to denote that state of body during life in which the pulsation of the heart and arteries cannot be perceived. The action of the lungs is suspended, and the blood no longer undergoes that purifying process so necessary to life. Hence the body becomes filled with impure blood, the powers of sensation and voluntary motion are suspended, and, if the proper means of restoration are not resorted to, death will speedily ensue. Asphyxia may be produced by various causes; as by whatever prevents the access of air to the lungs, strangulation, drowning, choking, &c.; or whatever interferes with the action of the nerves that are concerned in respiration, as paralysis, cold, stroke of lightning, &c. It may also be produced by breathing an impure or a too rarified atmosphere.

ASPIDIUM, *as-pid'-i-um* (Gr., *aspidion*, a little buckler), a genus of ferns (which *see*). The fronds of the species *A. fragrans* possess aromatic and slightly bitter properties, and have been used as a substitute for tea.

ASPIDURA, (*as-pi-du'-ra* (Gr., *aspis*, shield, *oura*, tail), a genus of fossil star-fishes, so named from the buckler-like arrangement of the bony plates which protect the arms.

ASPLENIUM, *as-ple'-ni-um* (Gr., *a*, not, *splen*, spleen), a genus of ferns, included in the sub-order *Polypodieæ*. Many species are common in Great Britain, being known as spleen-worts. They were formerly used in medicine, but have now fallen into disuse. *A. ruta-muraria* is popularly known as wall-rue. *A. trichomanes* is an elegant little fern, common on rocks and old walls: it is often cultivated in cases and on garden rockwork.

ASS, *ass*, (Lat., *asinus*), *Equus asinus*, an animal too well known, at least in a domestic state, to need description here. It is found wild in the same parts of Asia as the horse, and it is there that we find it make the best figure in a state of domestication. In those countries it would seem that the ass was tamed before the horse; and to this day, in the East, asses are far more generally used as beasts of burden and draught than horses. There, however, instead of being despised and neglected, care is taken to cultivate the breed, by crossing the finest specimens. Even the wild ass is procured for this purpose. The ass is, properly speaking, a mountain animal. Its hoofs are long, and furnished with an extremely hard rim, leaving a hollow in the centre, by which means it is enabled to tread with more security on the slippery sides of hills and craggy places. The ears are larger when in a domesticated state than when wild. Its most general colour is mouse-colour, with a blackish stripe extending along the spine to the tail, and crossed by a similar stripe over the shoulders. The female goes with young eleven months, and seldom produces more than one foal at a time. In eastern countries the domesticated ass is generally a much finer animal than it is in this country. The stupidity and obstinacy with which it is credited here may, doubtless, be attributed to systematic ill treatment. The milk of the ass, highly esteemed as nutritious in cases of consumption and weak digestion, contains more sugar of milk and less caseine than that of the cow. The hide makes excellent leather for shoes and the best material for drums; and, by a peculiar process, shagreen leather is made.

ASSIMILATION, *as-sim-i-lai'-shon* (Lat., *adsimilatio*, from *ad*, to, and *similis*, like), the act of organized bodies, by which they convert foreign substances into their own proper substance, by which food is converted into nutriment. (*See* NUTRITION.)

ASTEROIDS, *as'-ter-oids* (Gr., *aster*, a star, and *eidos*, like), a number of small planets revolving around the sun, between the orbits of Mars and Jupiter, four of which were discovered in the first decade of the present century, and the remainder since 1845. They are sometimes called *planetoids*, an expression meaning "like a planet," which conveys a better idea of their character, in contradistinction to fixed stars; and *extra-zodiacal planets*, because their orbits, unlike those of the larger planets, are not confined within the zodiac, The entire number discovered up to the present time is about 150. Flora, the eighth in order of discovery, is nearest to the sun, with a mean distance of 209,170,000 miles; and Euphrosyne, the thirty-first, the most distant, being about 300,000,000 miles from the centre of our solar system. They are all extremely small, seldom exceeding in brightness stars of the eighth magnitude; and the eccentricities of their orbits and the inclination of their planes to the plane of the ecliptic are much greater than those of the larger planets.

ASTEROLEPIS, *as-ter-o-le'-pis* (Gr. *aster*, a star, *lepis* scale), the star-scale, a gigantic fossil ganoid fish of the Old Red sandstone, so named from the star-shaped markings on the strong plates which protect the head. The structure of this creature is minutely described in Hugh Miller's work "Footprints of the Creator; or the Asterolepis of Stromness."

ASTEROPHYLLITES, *as'-ter-of'-il-lites* (Gr., *aster*, star, *phullon*, leaf), fossil plants found abundantly in the Coal-measures, Lias, and Oolite, characterized by star-like whorls of narrow leaves surrounding the jointed stems, as in the existing genera *Hippuris* and *Equisetum*.

ASTHMA, *asth'-ma* (Gr., *asthmazo*, I breathe with difficulty), is a disease of the lungs, characterized by difficulty of breathing, which comes in paroxysms, accompanied by a wheezing noise and a feeling of tightness across the chest. The fit occurs most frequently during the night suddenly awaking from sleep the patient, who is obliged to assume an upright posture, to prevent suffocation, and to struggle and pant for breath while the paroxysm continues, which is usually for two or three hours. Though a terrible, it is seldom, in itself, a fatal disease. It is frequently hereditary, or it may arise from some inflammatory affection of the respiratory organs. Among the other causes that may give rise to it, are dwelling in a moist or impure atmosphere, cold, indigestion, mental anxiety. The paroxysms are generally preceded by languor, flatulency, headache, sickness, a feeling of anxiety, and a sense of tightness and fulness about the chest. Physicians usually distinguish three kinds of asthma—the humid, dry, and spasmodic, according as they are, or are not, attended with cough and expectoration. During the paroxysm, gentle aperients and anti-spasmodic medicines are recommended. A blister on the chest, bathing the feet in warm water, a cup of hot coffee, or the smoking of stramonium, are frequently of use. To prevent the return of a paroxysm, the exciting causes are to be avoided; the bowels to be kept gently open, the food to be light and nourishing, sudden changes of temperature to be avoided, regular and moderate exercise to be taken, and a change of climate or of situation to be tried. As regards this last, it has been found that some have been least subject to asthma in the country, others in the centre of a town.

ASTIGMATISM, *as-tig'-mat-ism* (Gr., *a*, without, *stigma*, a mark or spot), a defect in the eye, which consists in its refracting the rays of light in different planes. The defect may be detected by looking at a small pinhole in a card held up against any bright object, and moved to different distances from the eye. To an ordinary eye the image of the hole remains circular at all distances, but to an eye having the peculiar defect in question the image of the hole, as the card is moved away, becomes elongated, and, at a certain distance, passes into a straight line.

ASTRÆA. (*See* CORAL, MADREPORE.)

ASTRAGALUS, *as-trag'-a-lus* (Gr., *astragalos*, a die), the name of the ankle-bone, or first bone of the foot, upon which the tibia moves. The lower surface rests on the *os calcis*, or heel-bone, to which it is attached by a strong ligament. It is a bone of great importance, as it supports the weight of the body in standing, and partakes of most of the movements of the foot.

In Botany, a genus of plants belonging to the natural order *Leguminosæ*, sub-order *Papilionaceæ*. More than 250 species have been described, and most of them are hardy plants, either shrubby or herbaceous. The best-known British species are *A. hypoglottis*, the purple milk-vetch, and *A. glycephyllos*, the liquorice-vetch. The species *A. verus*, *A. gummifer*, *A. creticus*, and some others, furnish gum-tragacanth, or, as it is frequently termed in the shops, *gum-dragon*. Tragacanth exudes naturally from all parts of the above plants, or from wounds made in the stems. *A. boeticus*, an annual species, is cultivated in Hungary, Germany, and other parts of Europe, for the seeds, which are roasted, ground, and used as a substitute for, or an improver of, coffee.

ASTRINGENTS, *as-trinj'-ents* (Lat., *ad*, to, and *stringo*, I tie fast), substances which have the property of contracting or drawing together the muscular fibre, and which are employed medicinally for the purpose of checking fluxes, hæmorrhage, and diarrhœa. The drugs most commonly used as astringents are alum, acetate of lead, catechu, oak-galls, and rhatany-root. Most vegetable astringents contain tannin.

ASTROCARYUM, *as-tro-kair'-i-um* (Gr., *astron*, a star, *karuon*, a nut), a genus of palms, including about sixteen species, all natives of tropical America, and remarkable for the formidable spines with which the stems, leaves, and other parts are armed. The fruits of *A. Tucuma* and *A. Murumuru*, are eatable. The species *A. vulgare*, the Tucum-palm, is cultivated by the Indians of the Amazon for the sake of the epidermis of the unopened leaves, which they make into strong and fine thread by twisting thin strips together. Beautiful hammocks are made of this tucum thread. The tucum-palm is much more lofty than the tucuma-palm.

ASTROLOMA, *as-tro-lo'-ma* (Gr., *astron*, a star, and *lobos*, a pod), a genus of plants belonging to the natural order *Epacridaceæ*. The species *A. humifusa* yields the Tasmanian cranberry. This fruit is about the size of a black-currant, but is of a green or yellowish colour, sometimes tinged with red, and consists of a viscid apple-flavoured pulp, inclosing a large seed. The flowers are of a beautiful scarlet.

ASTRONOMY, *as-tron'-o-me* (Gr., *astron*, a star, *nomos*, a law), the science which treats of the mechanism of the universe and the motions and positions of the heavenly bodies. Originally, astronomy formed part of the supposed science astrology, and men studied the stars in order to discover their influence upon future events. Thus the true science sprang out of the false. The difference between the two may thus be stated:—Astronomy was the knowledge of the laws regulating the motions of the stars, and astronomy was the interpretation of their supposed language. In process of time, the new science exposed the falsity of the old. The science of astronomy may be divided into three great branches:—*Geometrical* or *Mathematical*, *Physical*, and

Sidereal. The first relates to the magnitudes, shapes, and relative distances of the heavenly bodies, their orbits and the mathematical calculations required to ascertain the periods of their movements. The second branch relates to the nature of the forces operating in the universe, the composition and physical properties of the systems. Sidereal astronomy deals with the fixed stars, or those which do not form a part of our solar system. Practical astronomy is the application of the knowledge thus gained, the preparation and use of instruments for making observations, and the record of the results of observations. (*See* various headings.) Astronomical science has revealed to us "an innumerable company" of stars and nebulæ, to the number of which no limit can be set, diffused through an inconceivable extent of space. From 5,000 to 8,000 stars can be seen by the unassisted eye of an observer, and the most powerful telescopes have revealed the existence of nearly 50,000,000 of heavenly bodies; and there can be no reasonable doubt that still more powerful instruments would reveal millions more. Of these stars, our sun, the centre of our system, is one, and certainly not one of the largest; at the average distance of stars of the first magnitude, he would appear as only a star of the third or fourth magnitude. The more immediate and practical object of astronomical science is to ascertain the distances, movements, magnitude, and density of the members of our solar system; but, beyond that, there is an illimitable field for investigation.

History.—Astronomy is the most ancient of all the sciences. Long before the Christian era the Chinese, Chaldeans, Hindoos, and Egyptians are known to have studied the movements of the stars, and, according to the unanimous testimony of the Greek writers, the earliest traces of the science are to be found among the two latter peoples. The broad plains and extensive horizon of Chaldea afforded great facilities for astronomical observations, while their simple pastoral life gave them ample time for such studies. The Greeks, also, in their day, were efficient astronomers, and did much for the advancement of the science; they also have the merit of having studied for the sake of the science itself, while all the above-named people mingled it with astrology. The Chaldean priests observed and placed on record the rising and setting of the celestial bodies, and eclipses of the sun and moon, as stated by Diodorus; and they understood the Metonic cycle (*see* METONIC CYCLE); they used the clepsydra, or water-clock, to mark the lapse of time, and the gnomon and hemispherical dial, for determining solstices and the positions of the sun respectively. Alexander the Great found at Babylon a list of eclipses from 2234 B.C., more than 1900 years before the conquest of Babylon by that monarch, and sent them to Aristotle. The division of the ecliptic into twelve equal parts (the twelve signs of the zodiac), and that of the day and night into twenty-four hours, are ascribed to the Chaldeans. The Chinese records of astronomical observations claim to go back to the year 2857 B.C.; but they are very incorrect. The Chinese were acquainted with the Metonic cycle and the motions of the planets, and they had divided the year into 365¼ days; but they knew nothing about the precession of the equinoxes until about 400 A.D. In the year 221 B.C. the emperor Tsin-Chi-Hong-Ti barbarously ordered nearly all scientific books to be burned. In this manner it is said that a great mass of astronomical knowledge was lost. The Hindoo records are a series of observations known as the "Tables of Tirvalore," which are assumed to date from the year 3102 B.C., but are believed to have been fabricated from data derived by the Hindoo astronomers from the Greeks and Arabs. The Greeks derived their astronomical knowledge from the Egyptians in the first place; but the Egyptians have left no records of their observations. With the Greek philosopher Thales, who flourished about 640 B.C., the real and reliable record of facts connected with the history of astronomy may be considered to commence. Thales is said to have predicted a total eclipse of the sun, and was the first to show that the earth was a sphere, and not a plane surface, as the ancients imagined; and he also gave the Grecian sailors some idea of shaping their course by the stars. Pythagoras, who flourished about 500 B.C., did not consider the earth to be the centre of the universe, but, as it was afterwards shown by Copernicus, that the earth and other planets revolved round the sun. With the astronomers of the Alexandrian school, which flourished about 300 years before Christ, a regular system of observation was commenced. The paths of the planets in their orbits were determined; the relative positions of the fixed stars clearly laid down, and the constellations duly mapped out and catalogued. The first Alexandrian school of philosophy may be considered to have existed for 175 years, until the death of Hipparchus of Bithynia, the greatest of all the astronomers that lived before the Christian era. The second school commenced with Ptolemy, about 130 A.D., and ended with Pappus and Theon of Alexandria, early in the 5th century. The most celebrated astronomers in the first of these Alexandrian schools were Timocharis and Aristyllus, whose joint observations proved of much importance to Hipparchus, enabling him to discover the precession of the equinoxes. Contemporary with these was Euclid, better known to us as a mathematician; his clear and logical reasoning did much to pave the way for future discoverers, particularly those who turned their attention to the theory of the science. Some years later came Aristarchus of Samos, remarkable for being the first who attempted to ascertain the magnitude of the earth and its distance from the sun and moon; he was also a believer in the Pythagorean theory, that the earth revolved round the sun. Another celebrated astronomer of this school was Eratosthenes, who observed the obliquity of the ecliptic, and obtained some idea upon a true principle of the magnitude of the earth; he also made observations with astrolabes of his own construction, which existed at Alexandria in the time of Ptolemy. But the master mind of the first Alexandrian school was Hipparchus of Bithynia, the Newton of his age, who flourished from 160 to 125 B.C. He made a catalogue of 1,081 stars, determining the latitude and longtitude of each, which is the first list on which any reliance can be placed, as those attributed to Eratosthenes and others are devoid of bearings by which they can be recognized and identified. From his death to the time of Ptolemy, with whom the second school of Alexandrian philosophy commenced A.D. 130, no astronomer of eminence is met with. Ptolemy followed closely in the footsteps of Hipparchus, substantiating or altering the various theories which his predecessor had propounded. Among his chief discoveries were the libration of the moon and the refraction of light. He made a catalogue of the stars, based, most probably, on that of Hipparchus, with the positions corrected by the improvements he had been enabled to effect: he also invented a planetary system known as the Ptolemaic system (*see* PTOLEMAIC SYSTEM), which was generally considered to be the true principle of the motion of the universe, until Copernicus revived and extended the system originated by Pythagoras. His successors, with the exception of Pappus, who wrote a commentary on his works, and Theon of Alexandria, were men of little or no note. After the death of these philosophers, the second school of Alexandrian philosophy may be considered to have ceased, or, perhaps, to have languished until its total destruction by the Arabs, then called Saracens, about the middle of the 7th century. Fortunately, the Arabs preserved the writings of Ptolemy, and, in the year 762 A.D., commenced a diligent prosecution of the study of astronomy. Although they did not make any great discoveries, yet their careful observations led to the correction and more accurate determination of many facts that had been sought out by the inquiring minds of the old Greek astronomers. The most distinguished of the Arabian astronomers were Albategnius, or Al Batani, who flourished about 880, Ebn-Yunis, and Abul-Wefa. In Persia, Nasireddin compiled tables of observations, and gave them to the world in 1270; while Uleg Beg, a grandson of Timour the Tartar, made observations at Samarcand about the year 1433, and constructed the most correct catalogue of stars that had appeared up to his own time. This prince was as eminent as a geographer as he was as an astronomer. From this time, however, the study of astronomy has declined among Asiatic nations; their pursuit of the science being solely kept up for the sake of the study of astrology. In the early part of the 13th century, the attention of European nations was again turned to astronomy. Frederick II., emperor of Germany, ordered a translation of the *Almagest* to be made; and Alphonso X., king of Castile, collecting a great number of the most notable astronomers of the age about him, caused a set of tables to be compiled in the year 1252, which are known as the Alphonsine tables. (*See* ALONSINE OR ALPHONSINE TABLES.) From this time until 1500, when we come to the great name of Copernicus, no new discoveries were made, although many astronomers laboured and wrote. Copernicus completely revolutionised the science. He showed the fallacy of the Ptolemaic system, and introduced what has since been known as the Copernican system (*see* COPERNICAN SYSTEM), which is now known to be the true theory of the motion of the universe. He met with great opposition, and his theory was not esteemed at its true value, because he was unable to answer certain objections that were made to it, which have since been fully explained. The next famous astronomer was Tycho Brahe, born 1546. Commencing the study at a very early age, he soon determined to devote his life to it; and in 1582 he began his observations, on an island in the Baltic, near Copenhagen. He did not adopt the Copernican system, but substituted a theory of his own, known as the Tychonic System, in which he asserted that the earth was the centre round which the sun moved, but that all the other planets moved round the sun, continually circling about him as he moved onwards in his course round the earth. This theory was received more favourably than that of Copernicus, especially as it explained all the natural phenomena then known quite as well. In addition to the invention of the Tychonic system, he effected great improvements in the instruments then in use. He produced a catalogue of the fixed stars considerably more accurate than any which had preceded it, and made the first table of refractions. He also added greatly to what was already known of the motions of the moon, discovering the moon's variation and annual equation, the changing motion of her nodes, and the inclination of her orbit. He also made very important researches into the nature, course, and distance from the earth of comets, which were previously imagined to be atmospheric bodies. The next astronomers of eminence were Kepler and Galileo; the former of whom was born 1571, died 1630, and the latter born 1564, died 1642. The lives of these philosophers bring the history of astronomy to the middle of the 17th century. Building on the discoveries of Tycho Brahe, and his own investigations of the orbit of the planet Mars, Kepler was led to the conclusions demonstrated in what are called his First and Second Laws (*see* KEPLER'S LAWS), that the courses in which the planets move round the sun are ellipses, having the sun as one of the foci, and that the areas of the orbits are proportional to the times of revolution. His Third Law, that the squares of the periodic times of the planets are proportional to the cubes of their relative distances from the sun, was enunciated in 1618, nine years after the discovery of the first and second laws. Kepler did much to establish the system of Copernicus, to divest it of some of its errors, and to answer the arguments that had been previously urged against it. His last work was the compilation of the Rudolphine Tables, published about four years before his death. The telescope was first constructed in Holland by an optician named Lipperhey, and Galileo availed himself largely of the telescope. He greatly improved its construction and made one which magnified a thousand times. With the aid of this instrument, he soon discovered the satellites of Jupiter, the ring of Saturn, and the phases of Venus, as well as the hills and valleys on the moon's surface. He also asserted the truth of the system of Copernicus, which drew on him the displeasure of Paul V., of Rome, and in the subsequent reign of Urban VIII., in 1633, he was subjected to the tortures of the Inquisition which wrested from him a recantation of the Copernican system he had so ably advocated. After Galileo, the knowledge of astronomy was largely increased by the labours of various men, thus—Gassendi, in 1631, watched the transit of Mercury across the disc of the sun; Descartes, an eminent mathematician, published his Cartesian theory; Vernier invented the instrument which bears his name, to determine the smallest subdivision of space; Norwood had measured the meridian from London to York with great accuracy; Gascoigne, Auzout, and Picard independently of each other, applied the telescope to the quadrant, and the micrometer to the telescope; Huyghens constructed the first pendulum clock, and Moreton made use of the pendulum to assist him in his observations of the differences of the right ascension of the heavenly bodies; Gregory, in 1663, constructed a reflecting telescope; and Cassini, with many other valuable discoveries, ascertained the period of the rotation of Jupiter, and compiled the earliest tables of the satellites of that planet. The illustrious Newton, who was born in the year in which Galileo died, now brought forward the theory of gravitation. (*See* GRAVITATION.) It was many years before he could satisfy himself of the truth of his speculations, and determine the laws on which his wonderful discovery rested; but he ultimately published them in his *Principia*, in 1687. This discovery is perhaps the grandest effort of human genius that the world has yet witnessed. It completely revolutionised physical science. By observations of the comet of 1680, Newton found that in accordance with the laws propounded by Kepler, the orbits of comets about the sun were elliptic. He also invented fluxions, proved the form of the earth to be an oblate spheroid, and showed the influence of the moon upon the ebb and flow of tides. In 1669, he constructed his first reflecting telescope. Contemporary with Newton were Halley and Flamsteed. The latter held the post of first astronomer royal in the Observatory at Greenwich, founded in 1675. He was as eminent a practical astronomer as Newton was skilled in physical astronomy. In 1680, he determined the laws of the moon's annual equation; and fourteen years later, in conjunction with Newton, he commenced a series of observations for the improvement of the theories then held respecting the moon's motions, and the laws which Newton had arrived at respecting the reflection and refraction of light. He made a long catalogue of stars, in which important additions were made to those that had already been published, and many series of astronomical observations, which were given to the world in his valuable *Historia Celestis*. His successor, Halley, discovered the accelerated mean motion of the moon by the aid of the eclipses recorded at Babylon, and preserved in the great collection of Ptolemy. He also added considerably to our knowledge of the revolutions of comets and their nature. He was succeeded by Bradley, who discovered the aberration of light in the year that Newton died. This discovery furnishes incontrovertible proof of the truth of the Copernican system, by determining the fact of the earth's annual revolution round the sun. (*See* ABERRATION.) Bradley also observed the phenomenon of nutation, and at the time of his death he left behind him upwards of 60,000 observations. In 1731, Hadley invented the quadrant; later, Lacaille, Euler, D'Alembert, and Cassini produced valuable tables, and extended the researches that had already been made in the theories of the motions of the planets, precession, nutation, libration, and the advancing motion of the sun's apogee. Maskelyne, the fourth astronomer royal, originated the *Nautical Almanac* in 1767. In 1781, Herschel discovered the planet Uranus, and Laplace calculated the elements of its orbit. Six years after, Herschel constructed his 40-foot telescope, with which he discovered two of Saturn's satellites and the rotation of his ring, as well as the satellites of Uranus. He also found that the Milky Way consisted of closely-serried groups of countless stars, and that the motion of the satellites of Uranus was retrograde. The astronomical labours of the 18th century may be considered to be closed with the catalogue of nebulæ and clusters of stars found by Herschel, and the commencement of the great work of Laplace, the *Méchanique Céleste*. In the opening years of the present century, the discovery of the first four asteroids (*see* ASTEROIDS), between the orbits of Mars and Jupiter, was made by Piazzi, Olbers, and Harding; and since that time no less than 150 have been added to this group, fully substantiating the speculations on this subject entertained by Kepler. In 1846, the planet

Neptune was discovered almost simultaneously by a Frenchman, M. Le Verrier, and Mr. Adams, of the University of Cambridge: but M. Galle, of Berlin, was the first to place his observations of the newly-discovered heavenly body on record. Among the principal astronomical publications of the present century may be enumerated Piazzi's *Catalogue of the Stars*, the most complete that we have; Herschel's *Catalogues of Stars and Nebulæ*, and Brisbane's *List* of the same. Lubbock's *Researches on the Lunar Theory* and his star maps are equally important; as also are the numerous publications of Airy, Laplace, Challis, Lalande, and Arago. Among the principal instruments constructed since the year 1800 may be noted Troughton's mural circle, put up at Greenwich in 1812, and the telescope erected at Parsonstown by Lord Rosse. (*See* TELESCOPES.) In recent years, great numbers of observations have been published in relation to the sidereal heavens, multiple stars, and nebulæ. Chiefly by means of spectrum analysis, our knowledge of the physical nature of the sun, sun spots, &c., and of the other heavenly bodies, has also been largely increased. Every year our numerous and laborious astronomers are adding to our knowledge of this science. Other parts of this extensive subject will be found treated separately under their distinctive headings, such as Comets, Solar System, Spectrum Analysis, &c.

AS'TUR. (*See* GOSHAWK.)

ASYMPTOTE, *as-im'-tote* (Gr., *asumptotos*, not falling together), in Geometry, a line which approaches continually nearer and nearer to some curve, whose asymptote it is said to be, without ever meeting it. It is a property appertaining to the hyperbolic curve. (*See* HYPERBOLA.)

ATACAMITE, *a-ta'-ka-mite*, an ore of copper, found as a crust on lava thrown out by volcanoes, especially Vesuvius and Etna. It is also found in the volcanic regions of South America, and takes its name from Atacama, in Peru. In Bolivia it is found associated with veins of silver. Chemically it is regarded as a combination of protoxide of copper with chloride of copper. It is worked in South America as an ore of copper, and large quantities are sent to England to have the metal extracted. Atacamite frequently forms on the surface of copper exposed to the air or sea-water, and it forms the greenish incrustation observed on antique bronzes, commonly known as the *ærugo nobilis*.

ATAVISM, *at'-av-ism* (Lat. *atavus*, a great-grandfather), the re-appearance in animals or plants of traits belonging to their remote progenitors, which their immediate parents did not present.

ATAXIA, *a-tax'-i-a* (Gr., *a*, not, *taxis*, order), a term used in Medicine to denote want of regularity in the symptoms of a disease or in the functions of the body.

ATAXY, LOCOMOTER, *a-tax'-e*, a disease of the nervous system, otherwise known as *tabes dorsalis* or *posterior spinal acterosis*, manifesting itself principally by disordered movements of the limbs in locomotion. It arises from loss of the power of using the muscles harmoniously, and so properly performing the voluntary motions of the body, and maintaining its equilibrium. Until recently, it was supposed to be a form of paralysis, but that is not the case. The symptoms make their appearance slowly, and are now understood by pathologists to originate in a diseased condition of the posterior columns and posterior nerve-roots of the spinal cord. In some cases, ataxy appears to be hereditary, and it is more common with men than with women, and mostly affects persons of middle age. The cause is obscure, but supposed to be exposure to cold and privation, excessive sensual indulgence, or mental anxiety.

ATELES, *at'-e-lees* (Gr., incomplete), a genus of American monkeys, of that division of the Quadrumana termed *Sapajons*. The most distinctive characters of the genus are long, slender, but powerful prehensile tails; fore-hands almost entirely without thumbs, or possessing only the merest rudiment of the organ—whence the name of the genus; a dental system which, in common with all the American Quadrumana, consists of two molar teeth more than are possessed either by man or by corresponding genera in the Old World. Other prominent characters of the ateles are round small heads, limbs remarkably long and slender, corpulent bodies. These characteristics have obtained for the genus the name of spider-monkeys. (*See* SPIDER-MONKEY.) The genus comprehends the following species:—1, *Ateles paniscus*, or quata; 2, *Ateles marginatus*, or chuva; 3, *Ateles ater*, or cayou; 4, *Ateles Belzebub*, or marimonda; 5, *Ateles melanocheir;* 6, *Ateles arachnoides*, or brown quata; 7, *Ateles hypoxanthus*, the mono or miriki; 8, *Ateles subpentadactylus*, or chameck.

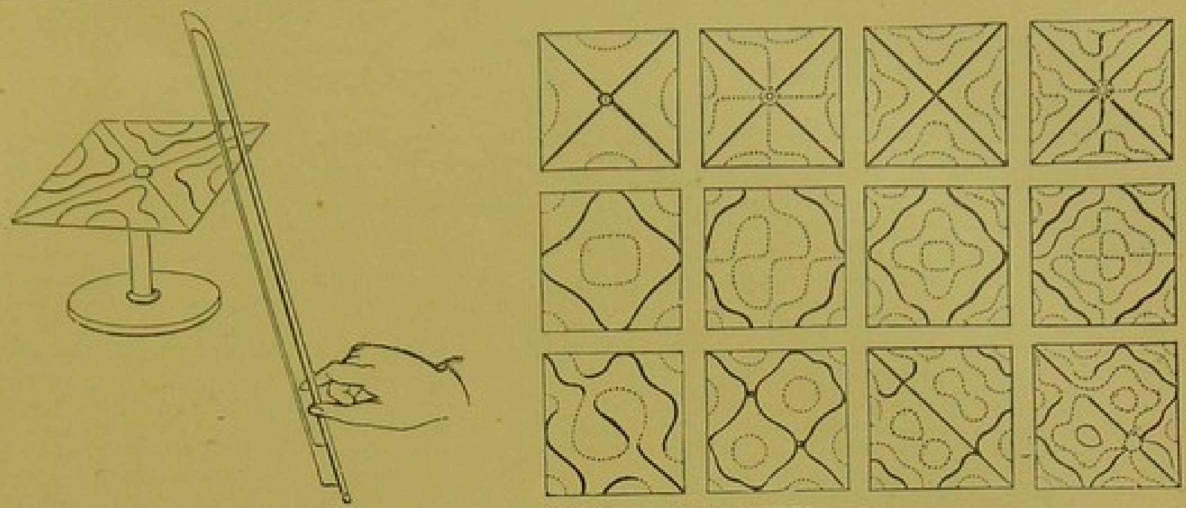
ATEUCHUS. (*See* BEETLE and SCARABÆUS.)

ATHERINE, *ath'-e-rin* (Lat., *atherina*), a genus of fishes, formerly classed with the Mullet family, but now separated from them. They rarely exceed six inches in length, and have a rather flat upper-jaw. Some possess very small teeth, while others are entirely toothless. All the known species have a silvery stripe on each side of the body. In the Mediterranean they are very numerous, and they also abound on the southern coast of England, as well as in certain parts of Ireland. At Brighton the atherine is called the sand-smelt; and in several market-towns of England where the smelt is unknown, the atherine is commonly sold under that name. It is generally caught by anglers from the shore, as it rises readily almost to any bait.

ATHEROMA, *a-ther-o'-ma*, a fatty deposit found in the tissues of aged persons, or those who have lived dissipated and ill-nourished lives. It arises from a diseased state of the blood vessels. The name is derived from a Greek word meaning porridge of meal, which the deposit somewhat resembles.

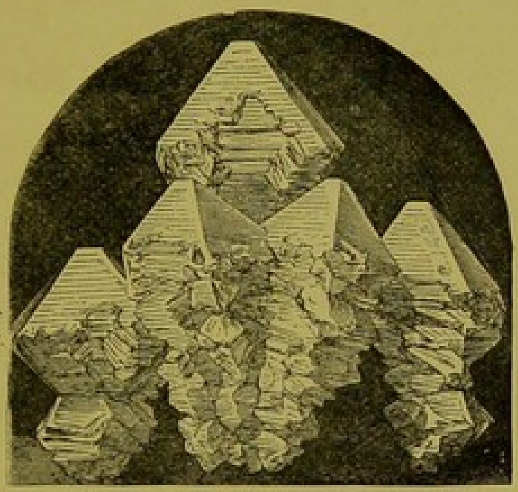
ATHEROSPERMACEÆ, *ath'-e-ro-sper-mai'-se-e*, the Plume Nutmeg family, a natural order of dicotyledonous plants in the sub-class *Monochlamydeæ*. Only four species are known, and these are all handsome and fragrant trees. Each produces fruit, consisting of a number of achænia inclosed in the tube of the calyx, and having persistent styles which have grown into feathery awns. The achænia of *A. Laurelia*, a native of Chili, have an odour very similar to that of the common nutmeg. *A. moschata* furnishes valuable timber, also an aromatic bark, which is used in some parts of Australia as a substitue for China tea.

ATMOSPHERE, *at'-mos-feer* (Gr., *atmos*, vapour, and *sphaira*, sphere), the name given to the gaseous envelope of the earth. It consists of two distinct portions, the permanent atmosphere, the amount of which does not depend on ordinary variations of temperature; and the vaporous portion, the amount of which is far less considerable than that of the permanent portion, and is varia-



ACOUSTICS—CHLADNI'S VIBRATORY FIGURES.

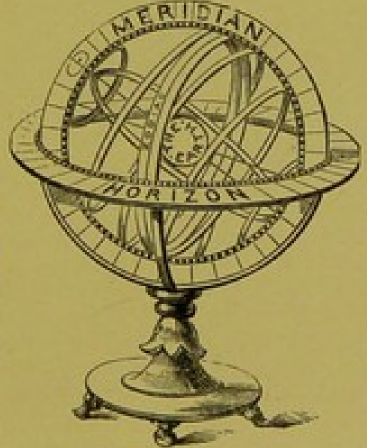
BOOBY.



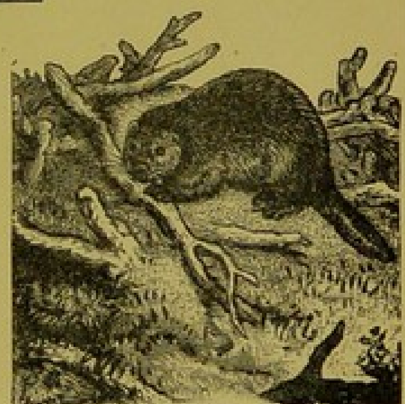
ALUM.

APTERYX.

BABYROUSSA.



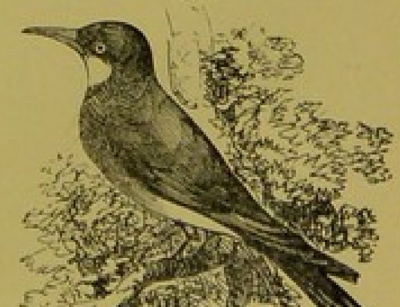
ARMILLARY SPHERE.



BEAVER.

BITTERN.

BONE, SECTION OF, MAGNIFIED.



BEE EATER.

ble with changes of temperature, &c. The form of this gaseous envelope of the earth is that of an oblate spheroid, more flattened at the poles than the earth is. This is the result of centrifugal force, which is enormously great at the equator and scarcely perceptible at the pole. The *height* of the atmosphere—that is, the thickness of the atmospheric belt—varies therefore, being in addition affected by the less density of the air at that part where its motion is most rapid. Many observations have been made to determine the height of the atmosphere. At one time, taking the duration of twilight as a test, it was considered to be about 45 miles. Observations of luminous meteors and auroral arches have also been made, and the best authorities now agree that the height of the atmosphere is at least 120 miles, and that in an extremely attenuated form above the equatorial regions of the earth, it may even extend to 200 miles. That the atmosphere has weight can be practically and very easily demonstrated. A hollow glass globe filled with air weighs more than the same globe does after the air has been extracted by the air-pump, the difference, of course, being the weight of the quantity of air withdrawn. A column of air is equal to a column of water of similar horizontal section very nearly 34 feet high, or a column of mercury of about 30 inches. The mercury weighs a little more than 14¾ lbs., consequently that is the weight of the corresponding quantity of air. The pressure of the atmosphere on a square inch being thus ascertained, the multiplication of the number of square miles on the earth's surface by the atmospheric pressure is a simple arithmetical operation, the result showing that the weight of the entire atmosphere is 11·67085 trillions of pounds (about 500 billions of tons), or rather would be if the pressure of the mercurial column were a constant quantity; but, in fact, it varies somewhat in different latitudes, at various seasons of the year and even hours of the day, owing in a great degree to the pressure of watery vapours, and the accumulation of air by the action of winds. The *density* of the atmosphere diminishes with distance from the earth. All gases are elastic, and those portions of the atmosphere in contact with the earth are pressed upon by all the air above them. The variations of density, though according generally with the deductions from theory, are yet marked by peculiarities of a somewhat complex nature, resulting from the duplex character of the atmospheric constitution. The following statement is approximately correct—at a height of seven miles the density of the atmosphere is reduced to one-fourth the density at the sea-level, and for every increase of height by seven miles, the rarity of the air is similarly quadrupled. The *chemical composition* of the atmosphere varies slightly (as compared with the entire mass) from different causes. The mean composition of 100 parts is about 79 nitrogen, 20 oxygen, and ·04 carbonic acid, and minute proportions of other gaseous matters as ammonia, carbonetted and sulphuretted hydrogen, hydrochloric acid, carbonic oxide, sulphurous and sulphuric acid, nitric acid, and probably iodine. The amount of carbonic acid increases with elevation, being nearly doubled at a height of 10,000 feet. Carbonic acid is being continually produced by the respiration of animals, the processes of combustion, and the decomposition of organic substances; so that there is no danger of the supply required by growing plants ever falling short. Boussingault has estimated that the quantity of carbonic acid produced in Paris every twenty-four hours amounts to nearly a hundred and six millions of cubic feet. The atmosphere, as a chemical agent, acts principally by oxidizing bodies exposed to its influence, more especially metals. The amount of moisture in the air increases its chemical effect. It varies according to weather and locality. The chemical influence of the air is seen in the disintegration of the hardest granitic and felspathic rocks, which gradually crumble away under its action, forming the kaolin or China clay of the potter. Metals for the most part rust, or become converted into oxide, in moist air; giving rise to precisely the same compound, as if they were burnt in the fire. The action of the air on metallic paints containing lead is very marked; they become speedily tarnished by the absorption of sulphur. Even glass is affected in this way, lead-glass especially becoming covered with a film of oxide or sulphide, from prolonged exposure to air and damp. Gold, aluminum, and one or two other metals, remain untarnished by exposure to air; but silver soon becomes covered with a film of sulphide. In addition to its gaseous constituents, the atmosphere contains watery vapour, drawn up by the action of heat, varying, as noticed above, in different localities, and at different seasons, and in the lower strata solid substances in extremely minute particles, the presence of which is revealed in the sunbeam. It is customary to estimate the force of steam and other fluid pressures by *atmospheres*—that is, in round numbers, at the rate of 15 lbs. per square inch for every atmosphere. (For information respecting other points connected with the atmosphere, *see* FLUID, ACOUSTICS, METEOROLOGY, DEW, RAIN, TEMPERATURE, WIND, ANEMOMETER, BAROMETER, HYGROMETER, RAIN-GAUGE, THERMOMETER.)

ATMOSPHERE OF THE PLANETS. From a great variety of analogous circumstances proving the common origin of the earth and the other heavenly bodies, there is strong reason for believing that many, if not all, of the planets are surrounded with gaseous envelopes or atmospheres. It is not, however, assumption alone that leads to this opinion; the telescope reveals to us such changes in the appearance of many of the planets as can only be accounted for by the fact that they have atmospheres. Mars, Jupiter, and Saturn have, in this way, been proved to possess a transparent atmosphere, varying at different times and places, like that of our own planet.

ATOLL, *a-tol'*, a peculiar form of coralline island, common in Polynesia and the Indian Ocean, consisting of a circular reef enclosing a sheet of water, or lagoon, connected with the ocean by an open passage. The reefs generally support vegetation, and are sometimes inhabited.

ATOM, *at'-om* (Gr., *atomos*, not to be divided). The finite or the infinite divisability of matter, and the consequent existence or non-existence of atoms which do not admit of farther division, were discussed in the earliest times of philosophical speculation. About four centuries before the Christian era, Democritus (commonly spoken of as "the laughing philosopher," but really a very acute observer of physical phenomena) held that the only existing things are innumerable indestructible atoms, varying in form and combined in obedience to mechanical laws. Epicurus (also a speculative philosopher of great powers, and certainly not, as ordinarily supposed, the propounder of the doctrine that sensual pleasure is the great end of life), adopted the views of Democritus, and they were supported also by the Roman poet Lucretius, in *De Rerum Naturâ*. The atomic theory received the support of Gassendi, in the middle of the 17th century; and the illustrious Newton was disposed to accept it and extend its signification. He says, "It seems probable to me that God, in the beginning, formed matter in solid, massy, hard, impenetrable, movable particles of such sizes and figures, and with such other properties, and in such proportions to space, as most conduced to the end for which he formed them. . . . That nature may be lasting, the changes of composed things are to be placed only in the various separations and new associations and motions of these permanent particles." The theory was elaborately expounded in a remarkable address delivered by Professor Tyndall, as President of the British Association for the Advancement of Science, at the Belfast Meeting of 1874. He said, "The atomic doctrine, in whole or in part, was entertained by Bacon, Descartes, Hobber, Locke, Newton, Bayle, and their successors, until the chemical law of multiple proportions enabled Dalton to confer upon it an entirely new significance." (*See* ATOMIC THEORY.) Endeavours to ascertain the limit of the size of atoms have occupied the attention of many of the most accomplished physicists of our time, especially Loschmidt of Vienna, Stoney the American, Williamson, Maxwell, Tomlinson, and Sir William Thomson. By calculations, founded on the thickness of a soap bubble, it has been found that an atom of soap, in the solid state, "cannot possibly occupy so much as the hundredth of a cubic, 2,600,000th of an inch." There we may well stop, keeping in view the possibility that these atoms are not final, but that each may be capable of still more minute sub-division. Beyond the point reached by scientific demonstration, there is abundant room for abstract speculation, of which the theory of Boscovich, which has found many advocates, may be taken as a specimen. "Matter consists not of solid particles, but of mere mathematical centres, from which proceed forces according to certain mathematical laws, by virtue of which such forces become at certain small distances attractive, at certain other distances repulsive, and at greater distances attractive again." In Chemistry, an *atom* is the smallest quantity of matter that can exist in combination, and a *molecule* (containing two atoms) that can subsist by itself.

ATOMIC THEORY.—To Dalton, the eminent chemist and mathematician of Manchester, is due the formulation of a theory of atomic proportions. The subject had previously been discussed, but no certain results arrived at. He began his investigations in 1803, and in 1808 and 1810, developed his theory in his "New System of Chemical Philosophy." He announced four laws:—1, *Definite proportions*, in accordance with which the nature and proportions of the constituent elements in every chemical compound are definite and invariable; as, for instance, in water, obtained from any source, the proportion of oxygen to hydrogen is invariably as 8 to 1 by weight, and in every carbonate of lime, however differing in form and other physical properties, there are 56 parts of lime to 44 of carbonic acid. 2, *Multiple proportions*, by which, when one substance unites with another in several proportions, the highest proportions are multiples of the first or lowest; thus, nitrogen and oxygen combine to form five chemical compounds, in all of which the properties of nitrogen remain constant, but that of oxygen is a constantly increasing multiple of its atomic weight. 3, *Equivalent* or *reciprocal proportions*, which means that each element, in combining with other elements, or in displacing other elements from combination, does so in a fixed proportion, which may be stated numerically, of which (to quote a recent authority) this example may be given:—"We have a compound of oxygen and iron containing these elements in the proportion of 8 to 28; we have also a compound of sulphur and iron in the proportion of 16 to 28; and sulphur and oxygen unite together to form sulphurous acid gas, which contains equal weights of the two elements—the proportion of 1 to 1 having a simple arithmetical relation to the proportion of 8 to 16." 4, *Compound proportions*, the law that the combining proportion of a compound substance is the sum of the combining proportions of its components; or, to quote an illustration from the same authority, the compound body, carbonic acid, which consists of 6 of carbon united with 16 of oxygen, has the combining proportion 22, which is the sum of the combining proportions of the carbon and oxygen composing it; and 22 is the proportion in which carbonic acid will form compounds with every other substance of similar chemical constitution.

Atomic Heat.—Equal weights of different bodies require different amounts of heat to raise them through the same number of degrees of temperature; but if, instead of using equal weights of the bodies, quantities in proportion to their atomic weights are employed, and the amounts of heat required to raise these quantities through one degree of temperature are determined, they will be found to be nearly identical. Regnault calls the number got by multiplying together those which express the atomic weight and specific heat of a body, its *atomic heat*. Taking sulphur as an instance, the atomic weight is 32, the specific heat 0·1776 of a unit of heat, and those numbers multiplied give 5·6832.

Atomic Volume.—Atomic volume is the relative *size* of the combining proportions or atoms of bodies, just as atomic weight is the relative *weight* of their combining proportions or atoms. It is determined by dividing the atomic weight by the specific gravity, which gives the atomic volume or space occupied by the aggregate of atoms as well as the interstitial spaces, the weight of the volume being proportional to the atomic weight of the body. The atomic volume, or its multiple, shows the proportions in which one body will unite with another body by volume.

Atomic Weight is the relative weight of the atoms of bodies, or, which is the same thing, the proportion in which they unite. Tables have been constructed of the atomic weights of all the elements, the atomic weights of compounds being evidently the sum of the atomic weights of their constituents. Hydrogen has been taken as the unitary body by English chemists, from being the lightest of all known substances. The continental chemists have taken 100 parts of oxygen as the standard number. There is great diversity in the relative sizes of elementary atoms, those of carbon being only half the size of those of iron. The weight of an atom of carbon would be 6, and that of an atom of iron would be 28; but the quantity of carbon would only take up half the space of the quantity of iron.

ATONY, *at'-o-ne* (Gr., *a*, not, and *tonos*, tone), is a term used to denote deficiency in power or tone, generally applied to muscular power.

ATROPA, *a tro'-pa* (Gr., *Atropos*, the name of one of the Fates), a genus of plants, formerly included in the order *Solanaceæ*, but now regarded as the typical genus of a natural order to which the name *Atropaceæ* has been given. The most important species is *A. belladonna*, the common Dwale, or Deadly Nightshade. This plant is a native of Greece, and also indigenous to Britain, but not common. It is perennial, and grows in hedges and waste grounds on a calcareous soil, but is only met with in a comparatively few localities. It blossoms from June to August, the flowers being about an inch long, drooping, bell-shaped, and of a lurid purple colour. The fruit is a berry of a shining violet black colour when ripe, about the size of a small cherry. The berries have a most tempting appearance, and children have frequently been poisoned by them. The are powerfully narcotic; and one of the first symptoms of their deadly action on the human frame is an appearance of the most besotted drunkenness. The dried leaves, or an infusion of the leaves, will act in a similar manner. The best antidote to the virulent effects of this poison is *vinegar*, when promptly administered; but, if practicable, the stomach-pump should be at once used. When death ensues from its effects, the body soon putrefies, and swells in a remarkable manner, being covered with livid spots; and blood sometimes exudes from the mouth, nose, and eyes. Extract of belladonna is employed to dilate the pupil of the eye during surgical operations, to allay pain and nervous irritation, and as an antispasmodic. A homœopathic preparation is administered to relieve neuralgia. The active principle of the plant is the alkaloid ATROPIA.

ATROPACEÆ, *a-tro-pai'-se-e*, a natural order of dicotyledonous plants, of the sub-class *Corolliflorœ*. The thirty-eight genera included in this order were separated by Miers from the *Solanaceœ* and *Scrophulariaceœ*. The species are very numerous, and abound in tropical regions; but some are found in most parts of the world. Many have powerful narcotic properties. (*See* NICOTIANA, DATURA, HYOSCYAMUS, ATROPA, and MANDRAGORA.)

ATROPHY, *at'-ro-fe* (Gr., *a*, not, and *trophe*, nourishment), a wasting, from deficient nutriment, either of a part or of the whole body. In order to the maintenance of the healthy state of the body or any of its organs, a certain supply of nutrition is required to meet the waste that is constantly going on. When, from any cause, the supply of nutrition is not able to meet this waste, the natural dimensions of those parts are reduced. In a healthy condition of body, an exact balance is maintained between the waste and the supply; but in every morbid condition this balance is more or less disturbed, in consequence of which the whole body, or certain parts of it, receive too little or too much nourishment. The first state, from whatever cause it arises, is termed *atrophy*, the latter *hypertrophy*. Progressive muscular atrophy (commonly described as wasting or creeping palsy) is an affection of the muscular system, characterized by the atrophy and subsequent paralysis of certain muscles, and is associated with morbid changes in the anterior roots of the nerves of the spinal cord. In all cases, atrophy arises from the diminution or perversion of the vital energies, generally the former; and hence, by exciting the natural vital energies of an organ, we tend to remove atrophy. In order to its cure, it is necessary to discover in what organ or organs the deficiency or perversion exists. The discovery of this is often difficult, and the removal of it, when discovered, is often more difficult.

ATROPIA, ATROPINE *a-tro'-pi-a*, a vegetable alkaloid found in the deadly nightshade (*Atropa belladonna*), and the seeds of the *Datura Stramonium*. It is extracted by adding sulphuric acid to a strong decoction of either plant; filtering, saturating with potash, and dissolving the precipitate, which is the atropia, in hot water, from which it crystallizes in long silky needles. (*See* ATROPA.)

ATTALEA, *at-tai'-le-a*, a genus of palms comprising numerous species, nearly all natives of the tropical parts of America. They have, in general, tall and smooth cylindrical stems; but a few species are stemless. The leaves are large and pinnate; the fruit a nut, with three seeds and three cells, enclosed in a dry husk. The species *A. funifera* is the most important member of the group. The fruits constitute the Coquilla nuts of commerce, which are largely imported into this country. The pericarp of this fruit is very hard, and forms a kind of vegetable ivory. The pendulous fibres of the leaf-stalks are much used for cordage, the ropes made from them being very strong, and extremely durable in salt-water. From the seeds of *A. Cahouni* a fatty oil may be obtained. *A. compta*, the Pindova palm, a noble tree, produces a fruit about the size of a goose's egg, the kernals of which are eatable.

ATTENUANTS, *at-ten'-u-ants* (Lat., *attenuo*, I make thin), a term applied to those remedies which, it is supposed, have the power to impart to the blood a thinner or more fluid consistence.

ATTRITION, *at-trish'-on* (Lat., *attritus*, worn or rubbed down), the wearing and smoothing of rock-surfaces by the passage of water charged with gritty particles, by the descent of glaciers, or by the passage of sand-drift.

AUCKLANDIA, *awk-land'-i-a*, a genus of plants belonging to the natural order *Compositæ*. The most interesting species is *A. costus*, a native of Cashmere, the root of which is supposed to have constituted the *costus* of the ancients. This root is commonly known in the north-western parts of India by the name of orris-root. It must not, however, be confounded with the true orris-root, which is furnished by a plant belonging to a very different order. (*See* IRIS.)

ATTRACTION, *at-trak'-shon*, the force or forces by which all bodies, of whatever size, exhibit a tendency to approach each other, and are held together when in contact. The attraction of the magnet for iron is a familiar instance. Newton, in his "Principia," published in 1687, was the first to suggest a theory of attraction to explain the phenomena of the universe. The nature of the power is considered under the headings, ADHESION, AFFINITY, CAPILLARY ATTRACTION, COHESION, ELECTRICITY, GRAVITATION, and MAGNETISM.

AUCUBA, *aw-ku'-ba*, a genus of plants belonging to the natural order *Cornaceæ*. The only known species is *A. Japonica*, which, as its name implies, is a native of Japan. It was introduced into Britain as a hothouse plant, but was soon found to be hardy enough to flourish in exposed situations. It is now a very common ornamental shrub, especially in the parks and suburban gardens of large towns. It is remarkable for its shining pale-green leaves mottled with yellow, which have obtained for it the common name of Variegated Laurel; but the female plant is alone known in this country; hence, it never yields seed, and can only be propagated by layering, or by slips or cuttings.

AUDITORY, *aw'-di-to-re*, is a term applied to certain parts of the organs of hearing; as the auditory nerve, *meatus auditorius*, &c. (*See* EAR.)

AUGITE, *aw'-jite* (Gr., *augé*, brilliancy), a mineral nearly allied to horneblende, known also as *pyroxene*. It is found in many volcanic rocks, such as basalt and porphyry, and consists of silicate of lime and magnesia. It is greenish-black or entirely black, and is generally more or less translucent, according to the amount of manganese and iron contained in it. It crystallizes in six or eight-sided prisms. A transparent green variety found in the Tyrol is used in jewellery.

AUK, *awk*, a name common to several species of web-footed birds, really all belonging to the family *Alcidæ*, the largest species, the Great Auk, is now supposed to be extinct, not having been seen for about thirty years. The last specimen captured is now in the British Museum. The wings of the great auk are but partially developed. In length it measures about three feet, and its wings scarcely exceed four inches. Though the wings are almost useless for aërial locomotion, they are well adapted for assisting the bird's progress under water. The food of auks consists of fish and crustacea, and other marine productions. The common puffin is sometimes called the Labrador auk.

Auk, Little (*Mergulus Alle*), is the most diminutive of the auk tribe, and the hardiest. The colder and wilder the region, there do they seem to congregate in larger flocks, and enjoy the inclement weather with as much relish as their human companions the Esquimaux. In the locality of Baffin's Bay they are found in large flocks; also at Melville Island. On the inhospitable wilds of Spitzbergen and Greenland thousands of these birds find a home. It very rarely visits this country; indeed, those that have been seen are more probably storm-blown castaways. The little auk is a compact, stout bird, about nine inches in length. The upper parts of the plumage are mostly black, the cheeks and under-parts white, the legs yellowish-brown, the bill black. In summer the front of the neck, which during the winter is black, assumes a paler hue. It lays one egg, of a pale-bluish green, and, like the preceding, affects the highest cliffs.

Auk, Razor-billed (*Alca torda*), larger than the preceding; when full grown, it measures about fifteen inches in length and twenty seven across the wings. This species is found also in the Arctic regions; but, unlike the great auk, is a frequenter of warmer climates, including the coasts of Great Britain, France, Holland, and Germany. These birds take up their abode on the highest cliffs attainable, and live together in large flocks. About May the auk colonies begin their task of incubation, sitting closely together in rows, one above the other. It is very remarkable, that, although the razor-billed auk lays but one egg, and so many hundreds are accumulated on the cliffs at one time, without any kind of covering to denote their respective owners, no inconvenience is occasioned; every auk knows its own egg, and probably in no instance is the paternity of a young bird questionable.

AURANTIACEÆ, *aw'-ran-ti-ai-se-e*, the Orange family, a natural order of dicotyledonous plants, consisting of trees and shrubs, often of great beauty. The order is included in the subclass *Thalamifloræ*. There are twenty-three genera, and about ninety-five species, chiefly natives of the East Indies, but generally distributed by the agency of man throughout the warmer regions of the globe. Their flowers are regular, and usually odoriferous; their fruits succulent and sub-acid, being examples of the *hesperidium* (which *see*). The plants abound in receptacles containing essential oils, which are much used in perfumery, for flavouring, and for other purposes. The oils are especially abundant in the leaves, the petals, and the rind of the fruit. The latter also contains a bitter tonic principle. The edible fruits known as the orange, lemon, lime, shad dock, citron, pompelmoose, forbidden fruit, Indian bael, and wampee-fruit, are the produce of this order. (*See* CITRUS, ÆGLE, FERONIA, COOKIA.)

AURELIA. (*See* CHRYSALIS.)

AURICLES, *aw'-rikls*, is the name given to two of the cavities of the heart. (*See* HEART.)

AURICULA, *aw'-rik-u-la* (Lat., *auris*, an ear), the name given to a species of Primrose (*see* PRIMULA) much cultivated in flower-gardens. It grows wild in the Alpine and sub-Alpine regions of Italy, Switzerland, and Germany; also on the Caucasus and the mountains of Syria. In the wild state it has comparatively small flowers, generally yellow, but occasionally red or purple. These have short stalks, and grow in an umbel on one scape or leafless stem. The leaves, which spring from the crown of the root, are of a dark green colour, and are usually covered with a mealy powder. The scape and the flowers are also dusted over with this peculiar meal. The auricula has been cultivated in Britain since the close of the 16th century; and an immense number of varieties, many of exquisite beauty and fragrance, have been developed.

Auricula, a plant-eating molluscous animal, comprehended in that class of Gastropods to which the common snail belongs. Its organs of respiration are formed for breathing air, but some have the power of living in water for a long time. It inhabits a shell somewhat oval in shape, and marked by wide plaits. *A. Midæ*, a native of the East Indies, is from the fancied or real resemblance of the shell to the ears of an ass, commonly known as Midas's ear.

AURICULATE, *aw-rik'-u-lait* (Lat., *auricula*, little ear), a term applied to a leaf having two small ear-like lobes at the base. The leaf of the Woody Nightshade (*Solanum Dulcamara*) is an example.

AURIFEROUS, *aw-rif'-e-rus* (Lat., *aurum*, gold, *fero*, I yield), a term used to signify that certain rocks and veins yield or contain gold; hence the terms "auriferous veins," "auriferous sands," &c.

AUROCH, *aw'-rok*, the *Bos bison* of Europe, a large animal of the ox family, very similar to the American bison, once abundant, but now existing only in the forests of Lithuania, and possibly the Caucasus. The fossil animal of the same kind (perhaps identical) the ure-ox (*Bos urius*, or *B. sprim genius*) found in the post-tertiary deposits, existed in Switzerland as late as the 16th century. It was a contemporary of the mammoth.

AURORA BOREALIS, *aw-ror'-a bor'-e-ai'-lis* (Lat., *aurora*, the morning, or light preceding sunrise, *borealis*, belonging to the north), a magnificent luminous phenomenon which appears in the northern heavens, and is commonly known as the Northern Lights. In this country it is rarely seen, and never in its full splendour; still the appearances observed are sufficiently striking and beautiful to excite our wonder and admiration. Very beautiful exhibitions were witnessed in this country in September, 1870 and 1872. Long shooting streamers are seen to dart across the sky, and these are generally attended by a beautiful glow of diffuse light, varying from green to deep purple, violet, and red. In days gone by, the *merry dancers*, or *northern lights*, as these appearances were commonly named, gave birth to many absurd superstitious terrors; and even now they are regarded as evil omens by some country folk. In the Arctic zone the aurora is frequently seen; indeed, it serves to break the monotony of the long dreary night, of some months' duration, which falls upon the inhabitants of that gloomy region every winter. There the meteor assumes a character of the greatest imaginable splendour. It first appears as an arch of light of a bluish-white colour, resting at each end on the horizon, and enclosing a dark segment. This luminous arch, which remains visible for several hours, may be considered to be a part of a luminous ring, elevated at a great distance above the earth's surface, and having its centre corresponding with some point near the North Pole. The bow of light does not remain stationary, but rises and falls, extends towards the east or the west, and breaks, now in one place, and then in another. After a while it generally shoots forth quivering rays towards the zenith. When such rays are projected from every part of the arch, and do not rise too high, the aurora presents the appearance of a comb. When the rays are of great length, they culminate in a point near the zenith, and form what is called the *boreal crown*. Then the whole heavens towards the east, west, and north present the appearance of a vast cupola of fire, supported by columns of coloured light. These phenomena are said to be accompanied by a crackling sound, like the crackling of sticks when fractured, and very like the sound produced when a powerful electrical machine is excited. The aurora borealis is intimately connected with the magnetism of the earth. The centre of the boreal crown is invariably found at a point in the heavens indicated by the prolongation of a freely-suspended magnetic needle; and during the occurrence of the phenomenon the magnetic needle is always greatly disturbed, sometimes deviating several degrees from its normal position. There seems, moreover, to be a connection between the magnetic poles of the earth in regard to the aurora, for, so far as can be ascertained, the meteor occurs simultaneously at both. The southern auroras have been witnessed by many navigators, and closely resemble the auroras of the north, and the name *Aurora Polaris*, or Polar Lights, might appropriately be given to both displays. The spectrum of the aurora is almost mono-chromatic, consisting of a single bright line. (*See* SPECTRUM.)

AURO-TELLURITE, *aw'-ro-tel'-lu-rite* (Lat., *aurum*, gold, and modern Lat., *tellerium*), an ore of tellurium containing gold and silver.

AUSCULTATION, *aws'-kul-tai'-shon* (Lat., *auscultare*, to listen), is a term applied to the method of ascertaining the healthy or diseased state of certain organs, by attending to the sounds they produce, either on being struck, or in the natural performance of their functions. In a stricter sense, the term auscultation is confined to the latter of these cases, the former being termed percussion. Auscultation is either immediate or direct, by the unassisted ear, or mediate, by the stethoscope. (*See* STETHOSCOPE.) It is chiefly valuable as aiding the physician to understand the character of diseases of the organs of circulation and respiration in the chest. It is also valuable in the investigation of many obscure internal affections, such as aneurisms and diseases of the æsophagus and stomach, in the detection of uterine tumours and in the diagnosis of pregnancy.

AUSTRALIAN MANNA, *aws-trai'-li-an man'-na*, a saccharine substance, exuded spontaneously by the leaves of several species of *Eucalyptus*, or gum-tree, natives of Australia. It resembles manna, but does not contain mannite, the sweet principle being a peculiar kind of sugar, to which the name *melitose* has been given. It is said to drop from the leaves of *E. mannifera* in pieces sometimes as large as almonds.

AUSTRAL SIGNS, *aws'-tral* (Lat., *australis*, southern; *signum*, a sign), an expression applied to the last six signs of the zodiac—namely, the autumnal signs Libra, Scorpio, and Sagittarius, and the winter signs Capricornus, Aquarius, and Pisces, because they lie to the south of the equinoctial.

AUTOMALITE, *aw-tom'-a-lite*, a species of corundum, found in octohedra. It consists principally of alumina and oxide of zinc, and generally occurs associated with zinc-blende and glance.

AUTOMATIC ACTIONS, *aw-to-ma'-tik*, is a term applied to certain muscular movements which are influenced simply by sensation, and not at all by the will.

AUTUMN, *aw'-tum* (Lat., *autumnus*), is the name of one of the four seasons of the year—that in which the fruits of the earth are gathered in. Astronomically speaking, it is the period during which the sun is passing from the autumnal equinox to the winter solstice (from 23rd September to 21st December). The inhabitants of the southern hemisphere have spring when those of the northern have autumn.

AUTUMNAL EQUINOX. (*See* EQUINOX.)

AVALANCHE, *av'-a-lansh* (Fr., from the Lat., *ad*, to, and *valles*, valley), an accumulation of snow descending from precipitous slopes of a high mountain into the valley below. Avalanches generally result from the partial melting of the snow in spring. The earth, warmed by the rays of the sun, melts the under layer, and thus destroys the adhesion of the mass to the surface. The least agitation of the air will sometimes cause the fall of an avalanche; and for this reason experienced Alpine travellers generally preserve strict silence when in the neighbourhood of dangerous masses of snow. In Switzerland, avalanches are common, and sometimes destroy entire villages. Four kinds of avalanches are distinguished. A *drift* avalanche consists of loose and powdery snow, set in motion by a strong wind; a *rolling* avalanche is that produced by a detached mass of snow rolling down the steep, and licking up the snow over which it passes; a *sliding* avalanche consists of an immense mass which has lost its adhesion to the surface through partial melting; lastly, a *glacial* avalanche is that made up of masses of frozen snow and ice from the higher reaches of the mountain.

AVANTURINE, *a-vant'-u-rine*, a variety of quartz, containing spangles of gold-coloured mica, which give it a peculiar play of colour, as if metallic particles were dispersed through its mass. It is of a yellow, red, and gold colour. It is now made artificially by mixing copper filings with glass while in a state of fusion. Artificial avanturine is far more lustrous than the real mineral. It is found in India, Spain, and Scotland, and is used in the manufacture of cheap jewellery.

AVENA, *av-e'-na*, the Oat, a genus of grasses (natural order *Graminaceæ*). (*See* OAT.)

AVERRHOA, *av-er-ro'-a*, a genus of plants belonging to the natural order *Oxalidaceæ*, and consisting of two species, both being small trees growing in the East Indies. They produce sour fruits, which are much eaten by the natives, but which are not relished by Europeans, except when in pickles. The botanical names of the species are *A. bilimbi* and *A. carambola*, and the fruits are known respectively as the Blimbing and the Carambole.

AVES, *ai'-veez* (Lat., birds), in Natural History, the second class of vertebrata. (*See* BIRDS.)

AVICENNIA, *av-i-sen'-ni-a*, a genus of plants belonging to the natural order *Myoporaceæ*. The species are natives of Australia and America, and grow, like the mangroves, in salt marshes. The bark of *A. tomentosa*, commonly called the white mangrove, is much used in Brazil for tanning. *A. resinifera*, which grows in New Zealand, yields a green resinous substance, which is eaten as food by the natives.

AVICULA, *a-vik'-u-la*, a genus of marine conchifera, the shell of which is imported in considerable quantities, and used, under the name of mother-of-pearl, in the construction of buttons, knife-handles, &c. The real commercial value, however, of this peculiar oyster rests on the real pearls often found in its interior. (*See* PEARL.)

AVICULOPECTEN, *a-vik'-u-lo-pek'-ten*, in Geology, a genus of fossil bivalve molluscs, peculiar to the carboniferous limestone, and often so well preserved that even the colours of the living shell are retained.

AVOCADO PEAR. (*See* PERSEA.)

AVOCET, OR AVOSETTA, *av'-o-set*. An aquatic bird which has a very thin, flexible bill, of a substance like whalebone, and turning hookwise, but in an opposite direction from the hawk and other tribes. The plumage of the avocet is black and white. It is usually ranked among the *Grallæ*, on account of the length of its legs, the long slender bill, and general similarity to the snipe. For scooping, probing, and beating the water, while the mandibles act as a strainer and retain the finny prey, the avocet's bill is most admirably adapted. The common avocet, *Recurvirostra avocet* is about the size of a lapwing, is strong on the wing, but not much addicted to swimming. It is found nearly all over the world.

AWN, a solitary pointed bristle in the flower of grasses. The character of genera and species are often derived from it, but it is not invariable, even in the same species, and the cultivated varieties of wheat and oats differ much in being more or less "bearded." There appears to be a tendency to the diminution or disappearance of the awn through cultivation.

AXE-STONE, a green variety of jade found in New Zealand and on the banks of the Amazon, and used by the natives for making hatchets.

AXIL, AXILLARY, *ax'-il* (Lat., *axilla*, armpit), the upper angle formed by the leaf with the stem is called the *axil*, and everything arising at that point is said to be *axillary*. Buds are usually axillary. Anything springing from the stem, either above or below the axil, is *extra-axillary*; if above, it may be described as *supra-axillary;* if below, as *infra-axillary*.

AXILLA, *ax-il'-la* (Lat.), is applied to that cavity under the upper part of the arm called the armpit. Hence the term axillary is applied to the arteries, veins, glands, &c., of this part.

AXINITE, *ax'-e-nite* (Gr., *axine*, an axe), a variety of garnet found in mica-schist in Dauphiné and Cornwall; so called from the axe-like form of its crystals.

AXIS, *ax'-is* (Lat., a pole, or axle-tree), a term applied to any line which divides a curve into two equal ymmetrical parts.

In Astronomy, the term is applied to an imaginary line passing through the centre of a heavenly body, around which it revolves. The axis of the earth is the line about which it revolves with an uniform motion from west to east. The poles of the earth are the points where the axis meets the surface.

In Botany, the term is applied to the central part both above and below ground, around which the whole plant may be said to be arranged. The stem is called the *ascending axis;* the root, the *descending axis*.

In Geometry,, the word axis is used to denote a right line around which a plain figure revolves to produce a solid. Thus, a semicircle, by moving round its diameter, describes a sphere, the axis of which corresponds to the diameter; a right-angled triangle, by turning round on its perpendicular, in like manner describes a cone, of which the axis is that perpendicular. The word is generally employed to designate a line which we may conceive to be drawn from the summit of a regular figure to the centre of its base.

In Physical Science, the word is used in many different senses. The *axis of a lens* is an imaginary line joining the centres of the two opposite surfaces of the glass. The *axis of a telescope* or *microscope* is a right line which passes through the centres of all the lenses in the tube. The *axis of the eye*, or *visual axis*, is the right line passing through the centres of the pupil and crystalline lens. The *axes of a crystal* are imaginary lines, about which the planes are symmetrically arranged. The *axis of rotation* is the line around which a body turns when revolving. The *axis of oscillation* is a line passing through the point about which an oscillating body—a pendulum, for instance—makes its vibrations.

AXIS DEER, *ax'-is* (*Cervus axis*) known also as the Chittra and Spotted Hog-deer, chiefly found in India, and also in many islands of the Eastern Archipelago. It is about the size of the fallow-deer, which it much resembles in size. It is of a rich fawn colour, spotted with white. The under parts are white; while a stripe of black runs along the back. The horns of the male are slender, sharp, and palmated. The female has no horns. Hunting the axis is a favourite sport, and its flesh is esteemed a great dainty.

AXOLOTL, *ax'-o-lotl* (*Siren pisciformis*), an amphibious animal, possessing both gills and lungs, thus being able to breathe either air or water. It is about 9 inches long; head broad and flat; the eyes situated near the muzzle; four legs with toes not webbed; the tail nearly as long as the entire body, and compressed at the sides, like that of the common water-newt. It is of an uniform brown colour, thickly mottled with small black spots. The axolotl is very common in the lakes of Mexico, and, according to Humboldt, inhabits the cold waters of mountain lakes. Dressed after the manner of stewed eels, it is often sold in the market-places of Mexico, in which country it is esteemed a great delicacy.

AXOTOMOUS, *ax-ot'-o-mus*, a term applied to minerals cleavable in the direction of their axis.

AYE-AYE, *ai-ai* (*Cheiromys madagascariensis*), a quadruped, about the size of a hare, often confounded with the *ai*, or sloth. It is now regarded as a connecting link between the Rodents and the Quadrumana. When first discovered, it was supposed to be a species of squirrel. It burrows underground, and is altogether a nocturnal animal. It has large flat bat-like ears, and its tail is long and bushy. Each fore-hand has five fingers, the third being singularly attenuated, and provided with a strong claw. The hind-legs are also furnished with prehensile hands. The entire body is clothed with long smooth hair, beneath which is an under-coat of a woolly nature. It measures about eighteen inches from nose to tail, and is found only in the forests of Madagascar, where it feeds on worms and insects. In confinement it will subsist on boiled rice and fruits.

AZALEA, *a-zai'-le-a* (Gr., *azaleos*, dry, arid —the habitat of the plant), a genus of plants belonging to the natural order *Ericeæ*, sub-order *Rhododendreæ*, remarkable for the beauty and fragrance of their flowers. Many of the species are extensively cultivated as ornamental plants: of these, the most common is *A. pontica*, a shrub from three to five feet high, with orange, red, or nearly white flowers. It is a native of the countries around the Black Sea, growing luxuriantly on the mountain-slopes, and often giving great brilliancy to the landscape. The whole plant is narcotic, and Trebizond honey owes its poisonous properties to the bees feeding on the flowers. Some of the finest species in cultivation are natives of North America; of these, the most deserving of notice are *A. nudiflora*, called, on account of its sweet odour, the upright honeysuckle, and *A. viscosa*, which, with *A. pontica*, have become the parents of numerous beautiful hybrids. *A. calendulacea* is a very beautiful plant. It is a native of the southern parts of the United States, where it is described as often clothing the mountain sides with a mantle of rich scarlet. The delicate azalea of the greenhouse, *A. indica*, is, as its name implies, a native of India. This species has lately met with a rival in *A. ledifolia*, an evergreen, which has been brought to this country from China. The azaleas are closely allied to the rhododendrons, from which they chiefly differ in having thin deciduous leaves, and by the flowers having five stamens only instead of ten.

AZIMUTH, *az'-e-muth* (Arab., *al samt*, the way, tract, or quarter). The azimuth of any heavenly body is the angular distance between the north or south point of the horizon and the point where it is cut by a vertical circle, or circle of altitude, passing through the heavenly body itself and the zenith. It is taken by aid of an altitude and azimuth instrument and a theodolite. The term *azimuth circle* is sometimes applied to vertical circles, the planes of which are perpendicular to the plane of the horizon. The *magnetic azimuth* is the angular distance between the point in the horizon cut by the azimuth circle of any heavenly body and the meridian of the magnetic pole. The sun's magnetic azimuth is found at sea by means of an azimuth compass. (*See* COMPASS.)

AZOBENZIDE, *a-zo'-ben-zide*, a substance obtained by the action of an alcoholic solution of potash on nitrobenzole. Its crystals are large and of a reddish-yellow colour. It must not be confounded with nitrobenzole or nitrobenzide, which is benzole in which an atom of hydrogen is replaced by an atom of peroxide of nitrogen; whereas, in azobenzide, it is replaced by an atom of nitrogen only.

AZOIC, *a-zo'-ic* (Gr., wanting life), a term applied to objects entirely destitute of organic life. The name *Azoic Age* is given by geologists to that period of the earth's history preceding the appearance of vegetable and animal life.

AZOLITIUM, *a-zo-li'-ti-um*, the principal constituent of litmus: it is amorphous, of a brown-red colour. It is insoluble, or nearly so, in alcohol and water, but dissolves readily in ammonia.

AZOTE, *az'-ote* (Gr., *a*, not, and *zoe*, life), the old name for nitrogen, so called from being destructive to life; as numerous other gases have the same fatal properties, the word has been almost given up by English chemists, except in such words as *azotized*, *azobenzole*, &c. The French, however, still use *azote*, *azotique*, *azotate*, &c., for nitrogen, nitric acid, and nitrate.

AZURE SPAR, a generic term sometimes applied to any and all minerals of an azure colour.

AZURE-STONE. (*See* LAPIS LAZULI.)

AZURINE, *a'-zhur-ine*, a fresh-water fish closely resembling and of the same genus as the roach, chub, &c. Its back is slate-coloured, its abdomen and fins, white. It was first described by Yarrell. In Lancashire it is known as the blue roach. It is also found on the Continent, especially in the Swiss lakes.

AZURITE, *a'-zhur-ite*, a mineral found in mica-schist of a beautiful azure hue. It is also called *lazulite*, from its faint resemblance to *lapis lazuli*, with which it must not be confounded. It consists of phosphate of alumina, magnesia, and protoxide of iron. The name is also applied to an ore of copper, closely allied to malachite, and sometimes known as *blue copper*.

AZYGOS, *az'-e-gos* (Gr., *a*, not, and *zugos*, a yoke), in Anatomy, is applied to certain parts of the human body that have no yoke or fellow— that, in other words, are single.

B.

BABIANA, *bab-e-a'-na*, a genus of plants belonging to the natural order *Iridaceæ*, and including numerous species, all natives of the Cape of Good Hope. The name is derived from *Babianes*, a word employed by the Dutch colonists to distinguish these plants, because their round subterraneous stems are greedily devoured by baboons. The leaves of all the species are narrow, plaited, and sword-shaped; the flowers are very similar to those of the genus *Gladiolus*, and are usually yellow, but sometimes purple, or even scarlet.

BABOOL, *ba-bool'*, the Indian name for the astringent barks of the *Acacia arabica* and *A. Catechu*. (*See* ACACIA, CATECHU.)

BABOON, *ba-boon'* (Fr., *babouin*) (*Cynocephalus*), a genus of Quadrumana, in which the tail is short and the nose prolonged uniformly with the jaws, the nostrils being open at the end of it, exactly as in the dog. The resemblance the baboon's head bears to the dog is its chief distinctive peculiarity. Its dentition agrees with that of the other monkeys; it has a long and truncate muzzle, cheek-pouches, and sharp claws, and is the fiercest and most repulsive of the Quadrumana. The common baboon (*Cynocephalus papio*) is a native of the coast of Guinea. It is of a uniform yellowish-brown colour, with a shade of light red on the head, shoulders, and extremities, the face, ears, and hands being naked and entirely black. It is furnished with whiskers, which have a backward direction, but do not conceal the ears. The rib-nosed baboon, or mandril, is the most remarkable of the genus. Its head is grotesquely large, its face long; it possesses scarcely any forehead, and its snout is blunt and abrupt. The eyes, which are very small, are sunk deeply in the head, and the cheek-bones very prominent and tinted with violet, purple, and scarlet. The hair rises above the forehead to a peak; and beneath the chin there is a small beard of orange-colour. Round the back of the neck the hair is long and inclines forward. The hinder parts of the animal's body, commencing from the loins, are marked with a soft violet, which gradually expands to the most vivid red. The tail is very short. Besides the baboons mentioned, there are the zelada of Abyssinia, the chacma of the Cape of Good Hope, and several others.

BABYROUSSA, *bab-i-roos'-sa* (*Sus Babirussa*), a large tusked hog, found in a wild state in India and the Indian islands. Its chief peculiarity is the possession of two protruding and curved tusks, turned upwards and backwards, so as very nearly to describe a semi-circle. The animal is further distinguished from the common hog by its slender build and the fineness of the bristles that cover its body. It is said that, when closely pursued, the babyroussa will, without hesitation, take to the water, and, by alternately swimming and diving, speedily elude its enemy. Its food is vegetable, and its flesh, according to travellers, superior to dairy-raised pork. It is sometimes called the Horned Hog.

BACCA, OR BERRY, *bak'-ka*, a many-seeded pulpy fruit, such as the gooseberry, *inferior* (adherent to the calyx) and *indehiscent* (not opening to allow the seeds to escape). The fruit of the grape is called a *nuculanium;* but it only differs from the bacca in being *superior* (free from the calyx). The name bacca is applied by some botanists to any fruit of a pulpy nature.

BACILLARIA, *ba-sil-lair'-i-a* (Lat., *bacillum*, little stick), a genus of *Diatomaceæ* (which *see*), consisting of silicious frustules of a prismatic form united into a brilliant chain, often in a zig-zag manner. They form beautiful microscopic objects.

BACK, *bak* (Ang.-Sax.), that portion of the human body which extends from the neck to the loins, and includes the dorsal vertebræ, the posterior portions of the ribs, and the muscles and skin pertaining thereto.

BACON-BEETLE. (*See* DERMESTES.)

BACTERIA, *bak-te'-re-a* (Gr., *bakterion*, a club), a name given by microscopists to certain plant cells, which are cylindrical, spherical, or oblong, but sometimes distorted in shape. They occur either single or compound, and multiply by transverse division; are propagated in water, and are not capable of transmission through the air. They are found very extensively, if not universally, in the vegetable and animal kingdoms, and play an important part in both healthy and morbid processes. Many of the phenomena of so-called spontaneous generation are due to these minute organisms.

BACTRIS, *bak'-tris*, a genus of palms consisting of nearly fifty species, all natives of tropical America. They are mostly small trees, with slender reed-like stems, some of which are no thicker than a goose-quill. The fruits, which are small, soft, and sub-acid, are greedily devoured by small birds. Tough fibres, used for making nets, are obtained from the stems of some of the species. The leaves of some are pinnate, while those of other species are entire.

BACTRITES, *bak-tri'-tes*, a genus of fossil *ammonitidæ* of which five species have been described. The shell is straight, and the septa ramified.

BACULITE, *bak'-u-lite* (Lat., *baculus*, a staff), a straight, many-chambered, conical shell, of the chalk epoch. In its internal structure it resembles the ammonite. From its prevalence in the chalk of Normandy, that rock has been termed the baculite limestone.

BADDERLOCKS, *bad'-der-locks*, sometimes called Henware, a seaweed (*Alaria Esculenta*), of the sub-order *Fucaceæ;* grows on rocks in deep water on the shores of Britain, Iceland, and other northern countries of Europe. Its stem is from 4 to 8 inches long, and is pinnated with a few short leaflets, which contain seeds. It has also a membranous olive-green frond which grows from 2 to 12 feet long, and has a stout mid-rib. The frond is stripped off, and the mid-rib is used as an article of food.

BADGER, *badj'-er* (*Meles Taxus*), a carnivorous quadruped inhabiting most parts of Europe and Asia. It was classed by Linnæus among the bears, but separated from that group by succeeding naturalists. It is now regarded as forming a connecting link between the bears and the *Mustelidæ*, or otters and weasels. It bears the greatest resemblance to the skunk, the dentition and habits being almost identical, moreover, both animals possess the power of secreting a disagreeable odour, which they can give forth at will. The teeth of the badger differ from those of the bears in the large size of the tuberculous molars, which shows that they are more adapted to vegetable food. It is almost omnivorous in its diet, eating indiscriminately roots and fruits of all kinds, eggs, birds, frogs, snails, worms, honey, and strawberries. It is also extremely partial to the larvæ of wasps and bees, to obtain which, it frequently digs up their nests, its thick hide rendering it careless of the stings of the infuriated insects. It is a slow and heavy animal, passing the day in sleep within its complicated burrow, and emerging at night in search of food. Its size is about two and a half feet in length ; its legs are very short, and its body flat; its eyes are very small, its neck short and thick, its tail stumpy, and its hide loose and tough. It was this last quality that in ancient times recommended the badger to folks of brutal mind as a fit subject to pit against mastiffs. Badger-baiting used to be a very favourite sport in England; and the badger's strong jaws and loose skin made it a formidable antagonist for a dog. No matter what part of the badger's body was seized, it could turn and fix its its teeth in its assailant, and inflict on it a terrible bite. The flesh of the badger is eaten in Italy, France, and China, and may be converted into hams and bacon. The skin, when dressed with the hair on, is impervious to rain, and is, therefore, very commonly used in covering travelling boxes. Its bristles are made into artists' and shaving brushes. The American badger (*M. Labradorica*), closely resembles the European species, but is, perhaps, more carnivorous. To this family also belong the ratels, or honey badgers (*Mellivera*). The best-known species is the Cape ratel (*Mellivera capensis*), which closely resembles the badger both in size and form, but is, perhaps, heavier in its appearance, and has the nose less developed. Its colours are grey above and black beneath. It burrows like the badger, not only to provide itself with a habitation, but also in search of the nest of the wild bees, of whose honey it is passionately fond. It has the same loose hard skin as the European badger, and in this leathery armour it is said to attack the citadels of these irritable insects with impunity. The verb *to badger* comes from the old cruelty of badger-baiting, and is expressive of annoyance and worrying by numerous assailants.

BAGSHOT SANDS, *bag'-shot*, a series of lower tertiary beds, consisting chiefly of light yellow sands reposing on the London clay, and occupying extensive tracts around Bagshot, in Surrey, and in the New Forest, Hampshire. They correspond to the Brocklesham beds (which *see*).

BALÆNA. (*See* WHALE.)

BALÆNOPTERA. (*See* RORQUAL.)

BALA LIMESTONE, *ba'-la* (from Bala, n Merionethshire), a series of limestone beds about 20 feet in thickness, alternating with slaty shales, and constituting a portion of the Lower Silurian formation of Wales.

BALANCERS, *bal'-an-sers*, a term applied to two slender membranous appendages, inserted on either side of the metathorax of insects belonging to the class *Diptera*. They are always small and movable, and vary much in size and form, according to the class of insects by which they are possessed. They usually consist of an elongated style with a small rounded head. Entomologists differ greatly as to the use of these organs. It is generally supposed they are the representatives of the posterior pair of wings, and are attached to the true metathorax. All dipterous insects possess balancers ; and as they keep them in constant motion, they are evidently of great importance.

BALANITE, *bal'-a-nite* (Lat., *balanus*, a barnacle), any fossil of the Barnacle family. The cirripeds, or barnacles, are not found in a fossil state beneath the Oolite.

BALANITES, a genus of plants belonging to the natural order *Amyridaceæ*. The most important species is *B. Ægyptiaca*, which is cultivated in Egypt for the sake of the seeds, which yield, by expression, a fixed oil called *zachun*. The leaves are slightly acid, and are reputed to be anthelmintic. The fruits when unripe are bitter and purgative, but when ripe, are eatable.

BALANUS, *ba'-la-nus*, a genus of *Cirrhopoda* (cirrhus-footed crustaceans), resembling barnacles, but distinguished from them by being destitute of a flexible stalk, and having a symmetrical shell. Popularly they are known as acorn shells. There are many species, and they are found in all seas attached between low and high water-mark to rocks, timber, &c., where they resemble a calcareous incrustation. When under water, they present a very pleasing sight, their valves and feathery cirrhi moving prettily and regularly, but out of water they appear quite dead. The larger species were esteemed a great delicacy by the ancient Romans. In the earlier stages of their existence they are not fixed to rocks as in their adult state, but swim actively in the water.

BALANOPHORACEÆ, *bal'-a-no-fo-rai'-se-e*, a natural order of dicotyledonous plants in the sub-class *Monochlamydeæ*. They are parasites, found growing on the roots of various woody plants, in the tropical and sub-tropical mountains of Asia and South America. They have no leaves ; their stems are of various colours, but never green ; their peduncles are naked or scaly, bearing spikes of flowers, usually white. Dr. Hooker enumerates thirty-seven species, which are divided into fourteen genera. Many are remarkable for their astringent properties ; others are edible, and a few secrete a kind of wax. Two plants of this order are worthy of note—namely, *Cynomorium coccineum*, and *Langsdorffia hypogæa*. The first is the *fungus melitensis* of pharmacologists, formerly highly valued as a styptic ; the second yields large quantities of wax, which is used for making candles by the inhabitants of New Granada.

BALANTIUM, *ba-lan'-ti-um*, a genus of ferns. The species *B. chrysotrichum* is a native of Java, and furnishes the silky hairs which are imported under the name of *Pakoe Kidang*, and occasionally used as a styptic.

BALAUSTA, *ba-laws'-ta*, the name given to a kind of fruit of which the pomegranate is the only example. It is inferior (*i.e.*, adherent to the calyx), many-celled, many-seeded, and indehiscent, and has a tough rind. It is formed of two rows of carpels placed above each other, and surrounded by the calyx; the seeds are attached irregularly to the walls or centre.

BALDNESS, *bawld'-ness* (Ang-Sax.), the loss of hair on a portion or on the whole of the head. It sometimes occurs in early years, but more frequently in old age. It also occurs after febrile or other severe illnesses. It is caused by an atrophy of the follicles on which the hairs depend for nutrition, and generally commences on the crown of the head. Many nostrums are recommended for the cure of baldness; but they are seldom attended with any good result, and frequently do harm.

BALDWIN'S PHOSPHORUS, *bawld'-wins*, nitrate of lime, which, when fused and exposed to the sun's rays, emits a phosphorescent light for a long time if taken into the dark. This phenomenon was first discovered by Baldwin in 1675, and is supposed to be caused by evaporation of the water of crystallization. The reaction is as yet unexplained. (*See* FLUORESCENCE, PHOSPHORESCENCE.)

BALEARIC CRANE, *ba-le-ar'-ic* (*Balearica pavonia*), a beautiful crane of Northern and Western Africa, conspicuous for its crown of golden plumes and scarlet cheeks. It is of bluish slate colour, and about four feet high, with a shorter and thicker bill than that of other cranes. It is easily tamed and of a gentle and playful disposition.

BALISTES, *ba-lis'-tees*, popularly known as the *File Fish*, a genus of osseous fishes, inhabiting the tropical and sub-tropical seas. They belong to the order *Plec tognathi*, and like the other members of the same genus, the skeleton is very incomplete. The body in some of the genera is covered with large rhomboidal scales, and in others with small rough scales, with stiff bristles densely crowded together. The most notable feature of these fish is the power of instantaneously raising or lowering the first dorsal spine.

BALLOTA. (*See* HOREHOUND.)

BALM. (*See* MELISSA.)

BALM OF GILEAD. (*See* BALSAMODENDRON.)

BALSAM, *bawl'-sam* (Gr., *balsamon*), a name formerly given to almost every oily or resinous aromatic substance exuding from trees, or to any healing application to wounds and sores; but now used by scientific men to denote a vegetable product containing either benzoic or cinnamic acid. The true balsams are much used in medicine on account of their stimulating, expectorant, and tonic properties. The most important are the balsams of Peru and Tolu (*see* MYROSPERMUM), benzoin (*see* STYRAX), storax, and gum-wax (*see* LIQUIDAMBER). All those substances are very fragrant. They vary much in their consistence. Thus benzoin is solid, hard, and brittle; Peruvian balsam is fluid; and Tolu is intermediate, being a very soft and readily-fusible solid. Copaiva, commonly called balsam copaiva, is not a true balsam, but belongs to the class of oleo-resins. Several medicinal mixtures, in which oils enter, are commonly included under the head of balsams. Thus, the preparation known as balsam of sulphur, used as an application to foul ulcers, consists simply of flowers of sulphur in olive-oil.

In Botany, the name is also applied to a natural order of herbaceous plants, the Balsamineæ of botanists. (*See* BALSAMINACEÆ.)

BALSAMIFLUA, *bal-sa-mif'-lu-a*, a natural order of dicotyledonous plants, consisting of only one genus. The species are balsamiferous trees found in the warmer parts of India, North America, and the Levant. By some botanists the order is named *Altingiaceæ*. (*See* LIQUIDAMBER.)

BALSAMINACEÆ, *bal'-sa-mi-nia'-se-e*, the Balsam family, a natural order of dicotyledonous plants, in the sub-class *Thalamifloræ*. There are but two genera, *Impatiens* and *Hydrocera* (*see* these words), which include 110 species. These are scattered over the globe, but are chiefly natives of India, growing in damp shady places, and where the temperature is moderate. They are all herbaceous plants, with succulent stems containing much watery juice. The flowers are very irregular, and the petals often finely coloured. The most familiar example is the beautiful *Balsamina Impatiens*, so often cultivated in our greenhouses. The fruit is five-celled, and usually bursts with elastic force so as to scatter the seed over a considerable area. The plants are said to have diuretic properties, but they are never used in medicine.

BALSAMODENDRON, *bal-sa-mo-den'-dron*, an important genus of plants or shrubs, belonging to the natural order *Amyridaceæ*. The species are natives of the East, and are remarkable for the odoriferous gum-resins which exude from their trunks. They have small green flowers, little oval fruits, and pinnated leaves with 4 or 5 leaflets. *B. myrrha*, a small tree growing in the north-eastern parts of Africa, and in the adjoining parts of Arabia, is believed to be the principal, if not the only source of the fragrant gum-resin known in commerce under the name of *myrrh*. It is at first soft, oily, and of a yellowish-white colour; on exposure to the air it soon acquires the consistence of butter, and in time becomes much harder, and changes to a reddish hue. Medicinally, myrrh is regarded as a tonic, stimulant, expectorant, and antispasmodic, when taken internally; as an external application, it is astringent and stimulant. It is an ingredient of the incense burnt in Roman Catholic chapels, and of some kinds of pastiles which are used for fumigation. The substance called *balm of Gilead*, or *balm of Mecca*, and which is supposed to be the *balm* of the Old Testament, is obtained from trees of this character. This substance was, in ancient times, regarded as a cure for almost every disease; but it is seldom used at the present day. The finest variety is obtained by making incisions in the stem, when a turbid white liquid appears, which, on exposure, becomes of a golden yellow colour, and of a like consistence to honey. The gum-resin, known as *Indian bdellium*, or *false myrrh*, and supposed to be identical with the *bdellium* of Scripture, is the produce of two species of this genus. It is the *googul* or *guggur* of the Beloochees, and the *mokul* of the Persians. It is very similar to myrrh. *African bdellium*, another of the gum-resins of commerce, is said to be an exudation of the species *A. Africanum*.

BALTIMORE BIRD, OR BALTIMORE ORIOLE, *Bal'-ti-more* (*Icterus Baltimorii*), a very beautiful bird found in all parts of North America, except the extreme north. In summer it flies as far north as 55° N. lat., but migrates to warmer climates during winter. It belongs to the natural family of *Sturnidæ* (of which the starling is our most common representative), and is quite distinct from the true Orioles (q.v.). The plumage of the Baltimore Bird is very brilliant, and its song is very agreeable. In size, it is a little less than the starling; its beak is slightly curved and very acute, the tail is slightly forked. It is very active, and builds a curious pendulous nest, usually seven inches long, and suspended from two twigs of a lofty branch.

BAMBOO. (*See* BAMBUSA.)

BAMBUSA, *bam-bu'-sa*, the Bamboo, a genus of plants found in tropical and sub-tropical countries throughout the world, and belonging to the natural order *Graminaceæ*, the Grass family. There are many varieties, all of which are graceful and noble-looking plants; for though they are merely grasses, according to the botanical meaning of the term, their thick, jointed stems sometimes reach the height of from 20 to 100 feet. The stems in each species arise from a strong-jointed subterranean-creeping root-stock, which shoots up from 10 to 100 stems. These are hard externally, being coated with flint; for instance, the stem of the *Bambusa tabacaria* (a native of Amboyna and Java), is so silicious that it strikes fire when struck with a hatchet. The stems of all the species are hollow, except at the nodes or joints, where strong partitions exist, and so divide the interior into a number of closed up cylinders. The cavities thus formed are usually filled up with soft loose pith. A peculiar flinty secretion, called *tabasheer* (which *see*), is found in the joints of some species, while others yield a saccharine juice called Indian honey. The stems of the different species of bamboo are applied to a multitude of useful purposes. Good paper is made from them in China and other parts of the world. The very young shoots are boiled and eaten like asparagus, and are also used for pickles and sweetmeats. The hollow stems are used as materials for houses, furniture, clothing, musical instruments, tools, and weapons, in all the countries where they flourish. Dr. Hooker says that in some districts a very large kind of bamboo is used for water-buckets, another kind for quivers, a third for flutes, a fourth for walking-sticks, a fifth for basket-work, a sixth for arrows, a seventh for tobacco pipes, and so on. In China we find the bamboo used for water-pipes and fishing-rods, and for making hats, shields, umbrellas, soles of shoes, baskets, ropes, paper, scaffold-poles, trellis-work, sails, covers of boats, and katamarans. The seeds of some species are cooked and eaten like rice, and are also used for making a sort of beer. The leaves also are used for thatch and for making hats. The bamboo is usually of rapid growth, and is often found in very arid soil. Some species have been found growing in the Himalayas, at an altitude of 12,000 feet.

BANANA. (*See* MUSA.)

BANANA BIRD (*Icterus Xanthornus*), an active and beautiful bird closely allied to, but larger than, the Baltimore bird (q.v.) It inhabits the West Indies and warmer parts of America, is gregarious, and builds a pensile nest like its cogener the Baltimore Bird. Its plumage is very beautiful, and, as it is easily domesticated, it is often kept in houses where it is useful for destroying insects.

BAND-FISH, OR SNAKE-FISH (*Cepola*), a genus of fishes related to the ribbon-fish, are remarkable for singularity of form and beauty of colour. The body is much elongated and compressed. The red band-fish (*C. ruberceus*) found in the Mediterranean, is about 15 inches long.

BANDICOOT, *ban-di-koot* (*Perameles*), a marsupial animal, indigenous to Australia. In some respects it is analogous to the opossum and kangaroo; but its hinder legs, though much longer than the anterior ones, do not present so great an apparent disproportion as in the last-mentioned animal. It is a nocturnal animal, and burrows for itself a dwelling in the soft earth, for which purpose its claws are well adapted. The flesh of the bandicoot is said to resemble that of the rabbit; but the food of the former is generally of a very different nature, consisting chiefly of insects and grubs. Its gait consists of a series of hops, in which, like the rabbit, it uses its fore feet. The long-nosed bandicoot (*P. nasata*) is about 18 inches long from the extremity of the snout to the root of the tail. Another species, *P. Gunnii*, is found in Tasmania.

Bandicoot, or Malabar Rat, *Mus giganteus*, sometimes known as the pig-rat, a native of India and Ceylon. It is the largest known species of rat, and not unfrequently is nearly 30 inches long. The natives eat its flesh, which is said to resemble young pork in flavour It feeds chiefly on grain and roots, and in wet weather stores up rice ready for the dry season.

BANEBERRY, *bain'-ber-e*, a name given to a species of *Actæa*, the root of which is sometimes used medicinally, on account of its antispasmodic, expectorant, and astringent properties. It is a perennial herbaceous plant, from one to two feet high, with triternate leaves, the leaflets of which are deeply cut and serrated. The flowers are in racemes; the berries are black and poisonous. This plant (*A. spicata*) is also known by the name of Herb Christopher. It belongs to the natural order *Ranunculaceæ*.

BANIAN TREE. (*See* BANYAN.)

BANKSIA, *bank'-si-a*, a genus of plants belonging to the natural order *Proteaceæ*, and so named in honour of Sir Joseph Banks. The species are bushes and small trees, found in all parts of Australia. They have hard, dry leaves, dull green above and almost white beneath. The branches bear, towards their extremities, long heads of very numerous flowers. The flowers secrete much honey; hence the name honey-suckle-trees commonly given to these plants by the colonists. One kind, the *P. grandis*, attains a height of 50 feet. Several species are much cultivated in British conservatories.

BANTAM FOWL, *ban'-tam*, a variety of the common fowl, first brought from the East Indies, and deriving its name from Bantam, Java. It is remarkable for its small size and its courage.

BANTENG, *ban'-teng* (*Bos Banteng or Bos Sondaicus*), an animal belonging to the ox family, the peculiarity of which is that the back rises into a high arch immediately behind the neck. It is a native of Borneo and Java, and in colour, formation of horns, and shape, it bears some resemblance to the Indian ox or Gaur. The formation of the skeleton is, however, somewhat different. Its colour is generally black with white legs, its limbs slender, and its sleek coat is covered with short hair.

BANXRING, *banks'-ring* (*Tupaia*), a genus of insectivorous animals, of which there are but a few species known, inhabiting the Indian archipelago. They present remarkable points of differences from other *insectivora* in having very elongated muzzles, and are more like lemurs or squirrels than any other animal, as they have soft glistening fur, a long bushy tail, and are able to run up trees with great agility.

BANYAN-TREE. (*See* FICUS.)

BAOBAB-TREE. (*See* ADANSONIA.)

BAPHIA, *baf'-i-a*, a genus of plants belonging to the natural order *Leguminosæ*, sub-order *Cæsalpinieæ*. The species *B. nitida* yields the dye-wood known in commerce as bar-wood or cam-wood. This dye-stuff is employed, in conjunction with sulphate of iron, to produce the dark-red colour of the English bandana handkerchiefs.

BAPTISIA, *bap-tis'-i-a*, a genus of plants belonging to the natural order *Leguminosæ*, sub-order *Papilionaceæ*. The species are numerous, and chiefly natives of North America. *B. tinctoria* is the wild indigo of the United States, yielding a blue dye, resembling, but much inferior to, indigo. This plant is used medicinally; the root and herbage being stated to possess antiseptic, sub-astringent, cathartic, and emetic properties.

BAR, in Physical Geography, an obstruction, consisting of sandbanks or rocks, which prevents the entrance of vessels into a harbour at low water. They are, for the most part, formed by the accumulation of earth, mud, and sand, washed away and brought down by the water of a river on its way to the sea. The rush of water, however, generally keeps clear one or two deep, narrow channels in the mass, which can be used for the entrance and exit of vessels; but, in some cases, the entrances to rivers have to be kept open by the continual removal of the accumulating detritus by dredging-machines constructed for the purpose.

BARB, *barb*, the name given to a fleet and vigorous breed of horses reared by the Moors of Barbary, and introduced by them into Spain. They are unusually nervous and long-winded, but, as a rule, are not remarkable for symmetrical beauty.

BARBADOES CHERRY. (*See* MALPIGHIA.)

BARBADOES GOOSEBERRY. (*See* PERESKIA.)

BARBARY APE, PIGMY APE, MAGOT, *bar'-ba-re*, a species of ape, interesting as being the only kind now left in Europe. It is about the size of a large cat, and is greenish-grey in colour, paler underneath. It has no tail, and is sometimes called the tailless monkey. The muzzle is not so much elongated as in the baboons, and the facial angle is much higher than theirs. It has small, round, reddish, lively eyes, and its ears resemble those of a human being. The face is nearly naked, and somewhat wrinkled. It usually walks upon four feet; but it can be tamed and taught to walk, though clumsily, on two. They are found in large numbers at Gibraltar, and inhabit the precipitous sides of the rock. They are gregarious, and live in parts of the rock inaccessible to man; but they are often seen in great numbers, the females carrying their young ones on their backs. They are very seldom destroyed, on account of the amusement they afford by their gambols and tricks. The Barbary ape probably came to Gibraltar from the north of Africa, where it is very abundant, and inhabits rocky mountains. Bands of them will often plunder gardens, while one of the number keeps a keen look-out. This species of ape possesses a considerable amount of intelligence, and is often seen tame in this country. They must, however, be taught when young, as they often grow sullen and vicious as they grow old; moreover, they are very unclean in their habits. They feed on roots, fruits, berries, &c., and their fondness for eggs has doubtless given rise to the ancient story of the pigmies and cranes.

BARBASTELLE. (*See* BAT.)

BARBEL (*Barbus*), *barb'-el*, a genus of fish of which there are several species, belonging to the *Cyprinidæ*. They frequent the quiet and deep parts of rivers, and swim with considerable strength and activity. The name is derived from the barbs or wattles attached about its mouth. Barbel have been found measuring three feet in length; but the average is two feet, and weight about ten pounds. The Thames produces barbel of a large size. They are fond of muddy pools and deep rivers, where they seek food by pushing in the mud with their snouts like swine. They feed on worms, insects, small fish, and the roots and leaves of aquatic plants. Only one species is found in England, the *Barbus vulgaris*. It is not good for the table, being very coarse eating, and poor persons boil bacon with it to give it flavour. Another kind, called the Binny, is found in the Nile, where it is very abundant and grows to a great size.

BARBERRY. (*See* BERBERIS.)

BARBET, *bar'-bet*, a family of birds, belonging to the *Picidæ*, and distinguished by their large conical beaks, and by being bearded with fine tufts of bristles directed forward. They exhibit points of resemblance both to the cuckoo and the woodpecker. They prey on insects and young birds, and also fruits and berries, and being of short wing, they generally wait with great patience on a branch and snap up the insects as they pass by. They inhabit warm climates in both hemispheres, and there are several species all of which are remarkable for gay plumage. The American puff-bird belongs to this family.

BAREGINE, *bar'-a-geen*. A deposit found in hot springs, and particularly in those at Barèges in France—whence the name. This deposit is the product of certain Algæ which grow in these springs. It imparts a meat-like flavour and odour to the springs, which is highly prized.

BARITAH, *ba-ri'-ta*. The name given to a genus of large birds found in Australia, and of which there are several species, the best known being the Piping Crow or Jar-ra-var-nang of New South Wales. Sometimes these birds are classed among the Crows (Corvidæ), and sometimes among the Shrikes (*Laniadæ*). The Baritah present points of resemblance to both.

BARIUM, *bair'-i-um* (atomic weight 68·5, symbol Ba), the metallic base of the alkaline earth *baryta*, which latter substance was first recognized by Scheele in 1774, the metal barium being first obtained by Davy in 1808, who named it *barium*, from the Greek word *barus*, heavy, on account of the excessive density of its compounds.

It may be formed by voltaic decomposition, from the anhydrous chloride, or by passing the vapour of potassium over red-hot baryta contained in an iron tube, a mixture of oxide of potassium and barium is formed, which is amalgamated with mercury. On distilling off the mercury in an atmosphere of hydrogen, the metal barium is left behind in a somewhat impure state. Owing to the difficulty with which it is prepared, little is known of its properties. Its specific gravity is said to be 4. It is of yellowish colour, and slightly malleable, rapidly oxidising in air, and decomposing water at ordinary temperatures. It has never yet been obtained in a mass but only in powder. It quickly tarnishes in the air, from the absorption of oxygen. When moderately heated, it burns with a deep-red flame.

BARK, *bark* (Dan.), the external coating of an exogenous or dicotyledonous stem and its branches. It is distinguished from the *rind* or *false bark* of an endogenous (such as palms, &c.), or of an acrogenous stem, by its mode of growth, and by the ease with which it may be separated from the wood beneath. The bark presents three distinct layers, independently of the epidermis which is common to it, with other external parts of the plant. These three layers, proceeding from within outwards, are known as the *liber*, or *inner bark*; the *cellular envelope*, or *greenlayer*; and the *suberous*, or *corkylayer*. Some botanists apply to these three layers, respectively, the Greek terms, *endophlœum*, *mesophlœum*, and *epiphlœum*. The bark is connected organically with the wood by means of the medullary rays and cambium-layer. (*See* STEM.) It develops in an opposite direction to that of the wood; for while the latter increases by additions to the outer surface, the bark increases by additions to the inner. Each layer of the bark grows separately; the two outer layers, constituting the cellular system of the bark, rarely continue to grow after a few years, but become dead structures on the surface of the tree. The inner bark, however, continues to grow throughout the life of the individual, by the addition of annual layers on its inner surface from the cambium-layer of the wood. In some trees, the oak for example, up to a certain age, these liber layers may be readily observed. (*See* LIBER.) The outer layers of the bark, from the distension to which they are exposed by the growth of the wood beneath, generally become cracked in various directions, and give a rugged look to the trunk, as in the elm and cork-oak. In some trees, however, as the beech, the bark always remains smooth, owing partly to the small development of cellular layers, and partly to the great distensibility of the layers. There are several kinds of bark which enter largely into commerce, being used for processes in the arts, or for medicines. These will be found noticed in separate articles, under the botanical names of the genera which include the plants producing them. For oak-bark, qeurcitron-bark, and cork (*see* QUERCUS); Peruvian bark (CINCHONA); cabbage-bark, Surinam bark (ANDIRA); cascarilla bark (CROTON); wild-cherry bark (CERASUS). (*See* also TANNING.)

BARK BEETLE, OR BARK CHAFER, a name given to many of the family of coleopterous insects known to naturalists as Xylophage, or wood eaters. They are all small, and generally of uniform colour, have hard bodies, and club-shaped antennæ. They bore holes in the bark, and deposit their eggs. Sometimes they appear in immense numbers and commit dreadful ravages.

BARKING-BIRD, *bar'-king* (*Pteroptochos*). A native of the South-American archipelago, building its nest close to the ground, among the underwood and fallen branches. Says Mr. Darwin, "Its name is well applied: I defy any one, at first, to feel certain that a small dog is not yelping somewhere in the forest."

BARLEY. (*See* HORDEUM.)

BARNACLE, OR BERNICLE, *bar'-na-kel* (Port., *bernaca*), a marine animal, which attaches itself to ships' bottoms and other submarine substances. It belongs to the genus *Cirrhopoda*, and is the type of a family of articulate animals distinguished by a long flexible stalk, which is provided with muscles upon the summit of which are five shelly valves, enclosing the principal organs of the animal, and opening and closing on one side. Barnacles abound in almost all seas.

Barnacle Goose. (*See* BERNICLE GEESE.)

BAROLITE, *bar'-o-lite*, (Gr., *barus*, heavy, *lithos*, stone), carbonate of baryta, or witherite. It contains 80 parts of barytes and 20 of carbonic acid. It is found at Alston Moor, in Cumberland, and at Anglesack, in Lancashire. It is much used in the North for poisoning rats.

BAROMETZ, *bar'-o-metz*, the prochate stem of a fern (*Aspidium barometz*), growing in the salt plains near the Caspian Sea. It has a sort of general resemblance to an animal with a silken down; and in past times was known as the Tartarian or Scythian lamb, and believed to partake of the vegetable and animal natures, and to eat grass.

BAROSELENITE, *bar'-o-sel'-e-nite* (Gr., *barus*, heavy, *selene*, lustre), native sulphate of baryta, or heavy spar. It occurs in modified rhombic and rectangular prisms; also in compact granular or fibrous masses. It is much used when ground for adulterating white lead. It contains 66 parts of baryta and 34 of sulphuric acid.

BAROSMA, *bar-os'-ma*, a genus of plants belonging to the natural order *Rutaceæ*. The leaves of several species, such as *B. crenata*, *crenulata*, and *serratifolia*, are used in medicine for their aromatic, stimulant, antispasmodic, and diuretic properties. They seem also to have a specific influence over the urinary organs. The plants yielding them are natives of the Cape of Good Hope. In commerce they are known as Buchu-leaves, and are thus named in the British Pharmacopœias. They contain a peculiar bitter principle called *Diosmin* or *Barosmin*, and a powerfully-scented volatile oil.

BARRICARRI SEEDS, *bar'-ri-kar-re*, the produce of the *Adenanthera pavonia*, a leguminous plant. They are of a bright red colour, and are employed in the northern parts of South America as beads for making necklaces.

BARRINGTONIA, *bar-ring-to'-ni-a* (in honour of the Hon. Daines Barrington), the typical genus of the natural order *Barringtoniaceæ*, consisting of small trees conspicuous for their beauty. *B. Speciosa*, the Moordilla, a native of Ceylon, has dark glossy leaves, and white flowers delicately tinted with crimson. Sir Emerson Tennent says that the stamens, of which there are nearly a hundred to each flower, when they fall to the ground, might almost be mistaken for painters' brushes.

BARRINGTONIACEÆ, *bar'-ring-to'-ni-ai'-se-e*, a small natural order of dicotyledonous plants, in the sub-class *Calyciflorœ*. They are usually placed among the *Myrtaceœ*, which they resemble in most essential particulars. The species are all natives of tropical regions, and most of them have poisonous properties. The bark of *Stravadium racemosum* is said to be febrifugal; the fruit of *Careya arborea* is edible; while that of *Gustava braziliana* is emetic, and produces an intoxicating effect upon fish.

BARTON BEDS, *bar'-ton*, a group of tertiary beds forming part of the Middle Eocene formation, included in the Bagshot series. They consist of greenish-grey sandy clay below, passing up into bluish-green and brown clay, interstratified occasionally with beds of sand and loam.

BARU. (*See* SAGUERUS.)

BARWOOD. (*See* BAPHIA.)

BARYSTRONTIANITE, *bar-i-stron'-shan-ite*, a mineral found in Orkney, containing a mixture of carbonate of strontia and sulphate of baryta. It is also known as Stromnite.

BARYTA, OR BARYTES, *ba-ri'-ta* (Gr., *barus*, heavy), one of the alkaline earths, discovered by Scheele, in 1774. It is met with, combined with sulphuric acid, in *cawk* or *heavy spar*, and combined with carbonic acid in *witherite*. It may be formed by decomposing the nitrate by a red heat. It is very similar in its properties to caustic lime. It is greyish-white; becomes hot when moistened with water, falling to a fine white powder, forming the hydrate. Its specific gravity is about 4. It has an extremely acrid caustic taste, and is very poisonous. It dissolves in 20 parts of water, forming baryta-water, much used as a chemical re-agent. Boiling water dissolves half its weight of baryta, and deposes, on cooling, four or six-sided prismatic crystals, containing 10 equivalents of water.

Baryto-Calcite, *ba-ri'-to-kal'-site*, a mineral containing carbonate of baryta and carbonate of lime; also called Alstonite, from being found in the lead mines of Alstone Moor.

BASALT, *ba-zawlt'* (from *basal*, an Ethiopian word for iron), a close-grained, hard, black, or dark-brown rock, of igneous origin, occurring both in the Trap and Volcanic series. It is one of the Dolerites or Augitic lavas, and consists essentially of augite and felspar, the former being in excess. It often contains crystals of the olive-green mineral *olivine*, grains of magnetic iron, and other bodies. Masses of basalt are frequently found divided into columns or prisms, with three, five, or more sides. That this columnar structure is the result of contraction on consolidation, is shown in the prisms usually being at right angles to the greatest extension of the mass—that is to say, being vertical in a horizontal bed, and horizontal in a vertical dyke—proving that the fissuring commenced at the cooling surfaces, and struck thence directly towards the centre of the mass. The pillars of basalt are usually from six to eighteen inches in diameter, and vary in length from five or six to 100 or 150 feet. Basalt is rarely, if ever, found as an underlying rock, but generally occurs as a dyke or as an overlying mass. The most celebrated plateau of basalt is that in the north-east of Ireland, covering almost the whole county of Antrim. This entire mass is 300 or 400 feet in thickness, and 50 miles long by 30 wide. The basalt occurs in three or four sheets, in many places beautifully columnar, and interstratified with beds of volcanic ash, or "ochre," as it is called. One of the columnar beds dips gradually into the sea on the north coast, and is known as the Giant's Causeway. The basalt of the west of Scotland is very remarkable for the beauty and regularity of its columns. At Fingal's Cave, in the island of Staffa, the arrangement of these basaltic columns was long regarded as the masonry of a race of giants.

BASE, *baiss* (Lat., *basis*, a foundation; Fr., *bas*, low), that part of a column on which the shaft is placed, consisting generally of a square plinth and mouldings, formed of tori, fillets, cavettos, and astragals, in various combinations, between the plinth and the bottom of the shaft. The height of the whole base, including plinth and mouldings, is about half the diameter of the shaft at its lowest or broadest end. The Greek Doric column is the only form of pillar that has no base. In Gothic architecture, the base became higher and more varied in form than in examples of orders of the classic period.

BASELLACEÆ, *bas-el-lai'-se-e* (from *basella*, its Malabar name), the Basella family, a small natural order of dicotyledonous plants, in the sub-class *Monochlamydeœ*. They are climbing herbs or shurbs, closely allied to *Chenopodiaceœ* (which *see*), but readily distinguished by having a coloured calyx, with two rows of sepals and perigynous stamens. There are four genera and twelve species, all of which are tropical plants. *B. rubra* and *alba* are used in the East Indies as substitutes for spinach. From the former species a purple dye may be obtained. The fleshy roots of *Ullucus tuberosus*, or *Melloca tuberosa*, a native of Peru, contain a great deal of starch, and are edible.

BASIL. (*See* OCYMUM.)

BASILISK, *bas'-i-lisk* (*Basiliscus*), a genus of Saurian reptiles, found in South America, and occasionally attains a length of three feet. Instead of the comb-like ridge of the iguana, the basilisk is furnished with a broad membrane running down its back, and a second, still broader, on the upper surface of its tail. This process is capable of either expansion or contraction. The hind part of the basilisk's head bears a remarkable pointed hood. Notwithstanding its unsightly appearance, the basilisk is a perfectly harmless reptile.

BASILOSAURUS. (*See* ZEUGLODON.)

BASIN, *bai'-sin* (Fr., *bassin*), a term applied to any dipping or disposition of strata towards a common centre, which has resulted from the upheaval and subsidence of the earth's crust. The tertiary formations often occupy limited areas, and fill up the basins of the older strata; hence the use of such phrases as "London basin," "Paris basin," &c. The *basin of a river* implies the area of drainage; the *basin of a dock*, a place where the water is confined by double floodgates, or a caisson, and thereby prevented from running out at ebb tide. The use of it is to contain ships either before they enter, or after they come out of the dock in which they are repaired. Basin also implies some part of a haven, which opens from a narrow channel into a spacious receptacle for shipping.

BASKING SHARK, *bas'-king shark*, a large, immensely strong, but still harmless species of shark. By the Irish it is called the sunfish. (*See* SHARKS.)

BASSE, OR SEA-PERCH, *bass*, a marine fish, the *Labrax Lupus* of Cuvier. The fishes of this genus belong to the family *Percidæ*, or Perches, with whom they are closely allied. The basse is to be met with along the British and Dutch shores, and abundantly in the Mediterranean. By the ancient Greeks aud Romans it was highly esteemed as an article of food. On account of its voracity, it was called by the Romans *lupus* (wolf), a name still retained as a designation of the species. Its length is generally from a foot to a foot and a half; but it has been found of a much larger size. There is an American species of basse, which is termed by Cuvier *Lupus macronatus*.

BASSET, *bas'-set*, a term applied by miners to the emergence at the surface of different mineral strata from beneath each other. It is also applied to openings from or into mines from the surface.

BASSIA, *bas'-si-a*, a genus of plants belonging to the natural order *Sapotaceæ*. The species are trees, natives of tropical or sub-tropical regions. They are remarkable for their fleshy flowers and oily seeds. In India, the fatty oils procured from the ripe kernels of *B. latifolia*, the Madhuca-tree, and *B. longifolia*, the Elloopa-tree, are made use of for burning in lamps, for culinary purposes, for making soap, and, medicinally, for external applications in cutaneous affections. The fleshy flowers and fruits are used as food, and from the former an alcoholic liquor is distilled. The wood of *B. longifolia* and other species is very hard and durable.

BASSORA GUM, *bas'-sor-a*, a whitish or yellowish substance brought from the neighbourhood of Bassora. It differs from most gums in being nearly insoluble in water. The plant yielding it is believed to be a species of *Mimosa*. It contains a peculiar principle, called Bassorin, which also exists in gum-tragacanth.

BAST, OR BASS, *bass*, a name commonly given to the inner bark of trees. Russian mats are manufactured from the bast of the lime-tree, and more than 3,500,000 are annually exported. (*See* LIBER.)

BAT, *bat*, the common name of a group of the class Mammalia, forming the order *Cheiroptera*, "wing-handed." Naturalists of an ancient date experienced a difficulty as to the proper classification of bats in the system of nature. The anatomical and intestinal structure of bats, combined with their viviparous nature, their hair, &c., without doubt entitles them to be ranked as quadrupeds. The anterior members are as completely organized for true flight as those of a bird. As in the birds, the bones supporting the anterior members are large, the humerus rather short, and the bones of the fore-arm long; but the latter are quite separate and movable, as in the human arm. The bones of the fingers, however, instead of being amalgamated, so as to form a single series, are all quite distinct, and, when extended, radiate widely from the wrist, the bones of which are of small size. The thumb is short, but the other four fingers excessively elongated: the first finger is the shortest, and the others of nearly equal length. The four long fingers and the bones of the arm are united by a delicate leathery membrane, which is also united to the sides of the body as far as the extremities of the hind-legs, and sometimes fills up the space between them; and it is by the agency of the broad wings, formed by the extension of the arms and fingers, that the bats are enabled to flutter through the air. The thumbs of the anterior feet are small, free, and furnished with sharp curved claws, by which the animals can suspend themselves to any convenient projection. The thumbs of the anterior hands and the hind feet are the only means by which the bat can progress along the ground, where, as might be expected, it is very awkward in its movements. The body is covered with a soft down, but the membrane of the wings only exhibits a few scattered hairs. The teats are placed on the breast, and the young, when sucking, cling to that part of the mother's body, and are carried about by her. Their senses of smell, hearing, and feeling, are very acute, and in some the nose is furnished with a membraneous foliation of most delicate structure, by which the sense of smell is greatly enhanced. The ears, in many kinds, are expanded, and capable of being folded down; while their full wings and the tissues of the ear and nose are so amply furnished with nerves as to enable them, even though deprived of sight, to pursue their flight through the narrowest passages without danger. On the approach of winter, the bat relapses into a state of lifeless inactivity, and in selecting a spot for hybernation, appears to regard security from molestation before any other consideration. At an earlier or later period of autumn, according to their species, they retreat, generally in large congregations of various species together, to the most retired places, as under the roofs of houses and churches, in caverns, in the hollows of trees, and similar situations, where they suspend themselves by their hinder claws, with their heads downwards. Here they crowd together, holding not only by the surface of the walls of their retreat, but by each other, one crowding over another so closely that it appears scarcely possible for such numbers to occupy so small a space. The common bat, or "flitter-mouse" (*Vespertilo pipestrellus*), is more frequently seen in this country than any of the others. It makes its appearance in the twilight of fine summer evenings in lanes and shady places, or haunts the vicinity of quiet streams, where any sort of nocturnal insects abound. Although not more than two and a half inches long, or about the size of the common brown mouse, it is very voracious, and must in a single evening consume a vast number of insects. The long-eared bat (*Plecotus auritus*), is the most elegant of the bats, and most easily tamed, learning to come at a whistle and take flies from the hand. The mouse-coloured bat (*Vespertilio murinus*), and the great bat (*Vespertilio noctula*), also count among the well-known British bats. The horse-shoe bat (*Rhinolophus*) resembles the common bats in its general habits, but is even more nocturnal, being satisfied with nothing short of absolute darkness for its place of retreat. The animal derives its name from the possession, above its nose, of a singular leaf-like membraneous appendage, shaped somewhat like a horse-shoe. The horse-shoe bats are abundantly distributed over the warmer regions of the earth, but Britain numbers but two of them—the great and little horse-shoe bat. The largest of these two measures two and a half inches in length, while the lesser is one of the smallest British species of the order. The most terrible of all the bats is the one that has earned for itself the title of Vampyre (*Phyllostoma spectrum*). Like the horse-shoe bat, it is furnished with a nose-crest; the canine teeth are large, and in almost all the species there are four incisors in both jaws. Some of them are so large as to measure two and a half feet across the extended wings. There can be little doubt that their favourite food is blood; but many of the stories respecting them are probably greatly exaggerated. The fruit-eating bats (*Pteropus*) are limited to the warm regions of Asia and Africa, the largest known bat is the Kalong of Java (*Pteropus Javanicus*), which measures four feet between the tips of its wings. About 130 species of bats are known.

BATATAS, *ba-tai'-tas*, a genus of plants belonging to the natural order *Convolvulaceæ*. The most important species is *B. edulis*, the Sweet Potato, a native of the East Indies, but now cultivated in all tropical and sub-tropical countries for its tubers, which, when roasted or boiled, form a wholesome and highly-nutritious article of food. Next to maize, the sweet potato is the principal food of the poorer classes in America.

BATHYBIUS, *bath-ib'-e-us* (Gr., *bathus*, deep, *bios*, life), the name given by Professor Huxley to a gelatinous substance found at the bottom of the sea, supposed to exhibit the lowest form of animal life. Many naturalists, however, deny that it exhibits any traces of life.

BATH STONE. A building stone extensively used on account of its beauty, is obtained from quarries in Wiltshire and Somersetshire. It belongs to the Lower Oolite, is five-grained, and, although easily cut in the quarry, hardens on exposure to the air; but is not very durable.

BATIDEÆ, *bat-i'-de-e*. A succulent and shrubby plant, *Batis maritima*, a native of the West Indies, where it is occasionally used as an ingredient in pickles. The order is closely allied to *Empetraceæ*, the Crowberries.

BATRACHIA, *ba-trai'-ki-a* (Gr., *batrachos*, a frog), soft and naked-skinned reptiles, such as frogs and toads, who in the early stage of existence respire by means of gills. (*See* AMPHIBIA, FROG, NEWT, REPTILE, &c.)

BATRACHOLITES, *bai-trai'-ko-lites*, in Geology, fossil remains of frogs and other animals of the same order. The skeletons, vestiges of the soft parts, and imprints of the feet of several genera of true batrachians, occur in the tertiary strata. In the pliocene deposits on the banks of the Rhine at Œningen and in the paper-coal of the Eifel, several species of frog, toad, and newt, have been found. Fossil frogs of a small species very similar to the recent abound in a dark shale overlaid by basalt in the vicinity of Bombay.

BATRACHOMYOMACHIA, *bat-ra-ko'-mi-o-mai'-ki-a* (Gr., *batrachos*, a frog; *mus*, a mouse; *mache*, a battle), literally signifies a battle of frogs and mice, and is the title of a Greek mock heroic poem usually ascribed to Homer, but without any good foundation. It seems to be indeed a parody upon the Iliad; and the contests of the beasts, their single combats, the intervention of the gods, and other Homeric incidents, are described with much humour. The authorship has been attributed to Pigres of Caria, who lived in the time of the Persian wars.

BATRACHUS. (*See* FROG-FISH.)

BAUHINIA, *baw-hin'-i-a* (so named in honour of the brothers Bauhin, botanists of the 16th century), a genus of plants belonging to the natural order *Leguminosæ*, sub-order *Cæsalpinieæ*. The species are natives of the warmer regions of both hemispheres. Most of them are twining plants, which stretch from tree to tree in tropical forests, like living cables; but a few are small trees, with erect self-sustaining stems. The leaves are generally divided into two equal globes, which circumstance is said to have suggested the idea of naming the genus after the two brothers. The flowers of some are large and very beautiful; but they rarely show themselves in the hothouse. The genus contains several very useful species. Thus *B. parviflora*, *racemosa*, and *valilii* yield tough fibres employed for making ropes; *B. retusa* and *emarginata* each produce a kind of gum; *B. variegata* has an astringent bark used in medicine, and for tanning and dyeing leather; the buds and dried flowers of *B. tomentosa* are also astringent, and are much employed by the Indian doctors in dysenteric affections. The snaken rod of Æsculapius is said to have had its origin in a portion of the stem of *A. scandens*, which had twined around a smaller stem. The Mopané-tree of South Africa is a species of *Bauhinia*. During the heat of the day the leaves of this tree fold up and become almost erect, so as to afford but little shade to the sun-oppressed traveller.

BAY, *bai* (Fr., *baie*), an arm of the sea extending into the land, not of any definite form, but smaller than a gulf, and larger than a creek. The term is, however, often applied to large tracts of water around which the land forms a curve, as Hudson's Bay.

BAY. (*See* LAURUS.)

BDELLIUM. (*See* BALSAMODENDRON.)

BEACH, *beech*, (Ang.-Sax.), a shelving tract of sand or shingle washed by the sea or a fresh-water lake, interspersed between the water and the land on which vegetation grows. The sea-beach is the space between low and high water-mark, particularly that part of it which is dashed by the waves; and the beach of a lake lies between the highest and lowest water-marks of its ordinary level.

Beaches, Raised. Banks of sand and shingle, with shells, found following the bays and recesses of the coast, at various heights above the existing beach or sea-margin. These give evidence of either elevation of the land or depression of the ocean, and point to times when sea and land stood at these successive levels. Along the coasts of Great Britain there are several notable examples, at heights about 10, 20, 40, and even 60 feet above the present sea-level.

BEADS, ST. CUTHBERT'S, a popular term for the detached bead-like joints of the fossils called *encrinites* (which *see*). They are found in great abundance on many parts of our coasts. The legend associating St. Cuthbert with these fossils is thus alluded to by Sir Walter Scott:—

"On a rock by Lindisfarne,
St. Cuthbert sits and toils to frame
The sea-born beads that bear his name."

BEAGLE, *bee'-gl*, a small hound, more remarkable for perseverance than speed, formerly employed in hare-hunting, but now superseded almost entirely by the harrier. The true beagle is rarely more than eleven inches high to the top of the shoulder, and in many cases much smaller. It has long ears: smooth-haired, and the colour is dark brown, or white, with black or reddish spots. Some breeds of beagles are very small. Queen Elizabeth had little "singing beagles" (so named from their very musical cry when hunting), one of which could be placed in a man's glove. Colonel Thornton, an eminent English sportsman, owned a valuable breed of minute lapdog beagles, and George IV., while prince of Wales, was in the habit of hunting with packs of well-selected dwarf beagles. Another well-known English sportsman, the late Colonel Hardy, once had a pack of beagles amounting to ten or twelve couples, and so diminutive in size that they were always carried to and from the sporting field in a large pair of panniers slung across a horse.

BEAK. (*See* BILL.)

BEAM-TREE. (*See* PYRUS.)

BEAN, *been* (Sax.), the common name for several leguminous plants yielding pulse. These will be described under the names of the genera to which they belong; thus, for broad-bean, *see* FABA; kidney-bean, scarlet-runner, and haricot (PHASEOLUS); ordeal-bean (DOLICHAS); Tonquin-bean (DIPTERYX).

BEAN-CAPER. (*See* ZYGOPHYLLUM.)

BEANS, IGNATIUS. (*See* STRYCHNOS.)

BEAR, *bair*, a general name of the *Tersidæ*, a family of plantigrade mammals distinguished by massive bodies, short limbs, and almost rudimentary tails, they belong to the order *Feræ*, and sub-order *carnivora*. Bears are generally inhabitants of the wooded districts of mountainous countries, and occur in all parts of both hemispheres, with the exception of Australia. Of all the carnivora, they are the most omnivorous in their diet, some of them living almost entirely on animal food. Roots, berries, worms, insects (especially ants), are equally relished by the bear; but, more than all, he delights in honey, to get at which he will climb trees and assault the strongholds of wild bees, though not uncommonly compelled to beat a retreat before the tiny sting-bearers. Generally, the bears are large heavy animals, with an awkward and shuffling gait. Their anterior limbs, however, are possessed of considerable mobility, and, despite their bulk and great weight, they exhibit great dexterity in climbing. The feet of the bear are armed with formidable curved claws, equally available for tearing a carcass or digging up a root. Bears are found in Europe, Asia, and North and South America, and in all climates, the species belonging to cold regions being generally most fierce and carnivorous. Old writers speak of them as being found in Africa, but, as far is known, no species is now to be met with in that continent, except in the north-western corner. Six species are European, six American, eight Asiatic, and one, the Polar bear, is common to the Arctic regions of both hemispheres. In northern countries, the bear retires during the winter season into caves and the hollows of trees, and remains dormant till the opening of the spring season, the vital action being sustained by the absorption of the fat, which, in their time of activity, acumulates rapidly. Young bears are born naked and blind, and remain in that condition for about five weeks, after which time they can see and the fur grows. The common or *brown bear* (*Ursus Arctæ*), is found in the temperate regions of Europe, Asia, and South America, and was in former times an inhabitant of Britain. It is generally about four feet long and two and half feet high. It is an animal of solitary habits. This bear is hunted for the sake of its fur and fat (the bear's grease of hair-dressers), and as food, bear-hams and bear-paws being considered a delicacy. The American *black bear* (*U. Americanus*) is large, and its fur is of considerable value, and about 10,000 skins are annually imported into Great Britain. The largest and most ferocious animal of the species is the North American *grisly bear* (*U. ferox*), found chiefly in the Rocky Mountains and the plains to the eastward. It measures about nine feet in length, has enormous claws, and can overpower and carry away a bison. All narratives of travel in the Far West abound with stories of encounters with the terrific "Grisly." The claws possess the singular property of independent action (not retractible like those of feline animals), each separate claw being as capable of distinct movement as the fingers of the human hand. The strength of this last-mentioned animal is so prodigious, that it can bear off an ox or bison weighing a thousand pounds. Should it find a carcass, and, being already full, have no immediate appetite for it, the grisly bear will dig a pit and bury it. This propensity to bury is very peculiar. Bear-hunters suddenly overtaken by the animal have stretched themselves along the earth and feigned death; whereon the shaggy sexton has immediately set about excavating a pit, into which the hunter was rolled and covered with earth. It is said that wolves, however famished, will not touch a body buried by a grisly bear, though they will devour any and the vilest offal chance may throw in their way. Another peculiarity of the animal in question is, that he does not hug his prey. His claws are broad, of great length, and edged like a chisel. Eyeing the object of attack intently for a moment, he rushes at it, rears, and strikes with his tremendous fore-paws. Sir John Richardson mentions the case of a hunter who was completely scalped, the skull being laid bare, and the hair turned right over the face, by a blow from the grisly bear's paw. The *Syrian bear* (*U. Syriacus*) is most probably the bear mentioned in the Scriptures. It is of a dingy white or brown colour. The *Polar bear* (*U. maritimus*) is a very large animal. The neck is long, the head flat, and the fur smooth and white. It is marine in habits, and never found far from the sea, living chiefly upon seals, fishes, and birds.

BEARD MOSS. (*See* USNEA.)

BEATSONIA, *beet-so'-ni-a*, a genus of plants belonging to the natural order *Frankeniaceæ*. The leaves of one species are used at St. Helena as a substitute for tea.

BEAVER, *bee'-ver* (*Castor fiber*), an animal of the order *Rodentia*, easily distinguished from the rest of the order by its peculiar tail, which is of a nearly oval form, horizontally flattened. The usual length of this animal is about two feet, exclusive of its tail. In colour, the beaver is reddish-brown, sometimes deepening into black; the coat consists of two kinds of hair, the longer comparatively coarse, smooth, and glossy; the under coat dense, soft and silky. The hind-feet are webbed, and adapted to the element in which the animal usually lives. There are two large glandular pouches near the tail, containing a substance known as *castoreum*, which emits a pungent odour. The incisor teeth are remarkably hard and sharp, and act like a chisel. According to Sir John Richardson, the Indians always used these teeth to cut bone and other substances, until the introduction of iron caused their disuse. The same authority says, "When the beaver cuts down a tree, it gnaws it all round, cutting it, however, somewhat higher on the one side than the other; by which the direction of its fall is determined. The stump is conical, and of such a height as a beaver sitting on his hind-quarters could make. The largest tree I observed cut down by them was about the thickness of a man's thigh, that is, six or seven inches in diameter; but Mr. Graham says that he has seen them cut down a tree which was ten inches in diameter." The sagacity and industry of the beaver have been the favourite theme of naturalists from the time of Buffon to the present day. As food the beaver chiefly prefers the bark of trees and such shrubs as the willow, poplar, and birch. It will eat berries in the summer. It lays up stores of food for the winter in the same manner as other rodents. This winter supply mainly consists of the bark and branches of trees. The northern part of North America is the great breeding-place of the beaver. The American species is known as the *Castor Canadensis*. In consequence of the use of silk and other materials in the manufacture of hats, the demand for beaver skins is much less than was the case some years back, when the eagerness with which the beavers were captured threatened the extinction of the animal. Some thousands of their skins are annually imported into this country. Beavers inhabit lakes, ponds, and rivers, as well as those narrow creeks which connect the numerous lakes with which North America abounds; but the two latter are chosen by them when the depth of water and other circumstances are suitable, as they have then the advantage of a current to convey wood and other necessaries to their habitations, and because, in general, they are more difficult to be taken than those that are built in standing water. The materials made use of are driftwood, green willows, birch, and poplars, if they can be got; also mud and stones intermixed in such a manner as must evidently contribute to the strength of the dam; but there is no other care or method observed in constructing the dams, except that the work is carried on with a regular sweep, and all the parts made of equal strength. The beaver-houses are built of the same materials as their dams, and are always proportioned in size to the number of inhabitants, which seldom exceeds four old and six or eight young ones. Instead of order or regulation being observed in rearing their houses, they are of a much ruder construction than their dams; for, notwithstanding the sagacity of these animals, it has never been observed that they aim at any other convenience in their houses than to have a dry place to lie on; and there they usually eat their victuals, which they occasionally take out of the water. So far are the beavers from driving stakes into the ground when building their houses, that they lay most of the wood crosswise and nearly horizontal, and without any other order than that of leaving a hollow or cavity in the middle. When any unnecessary branches project inward, they cut them off with their teeth, and throw them in among the rest, to prevent the mud from falling through the roof. It is a mistaken notion to suppose that the woodwork is first completed and then plastered; for the whole of their houses, as well as their dams, are, from the foundation, one mass of mud and wood, mixed with stones if they can be procured. The mud is always taken from the edge of the bank, or the bottom of the creek or pond, near the door of the house; and though their fore-paws are so small, yet it is held close up between them, under their throat. Thus they carry both mud and stones; while they always drag the wood with their teeth. All this work is executed in the night; and they are so expeditious, that in the course of one night they will collect as much as amounts to some thousands of their little handfuls. As they are frequently seen to walk over their work, and sometimes to give a flap with their tail, particularly when plunging into the water, this has, without doubt, given rise to the vulgar opinion that they use their tails as a trowel with which they plaster their houses; whereas that flapping of the tail is no more than a habit, which they always preserve, even when they become tame and domesticated, and more particularly so when they are startled. The beaver is found in Europe, chiefly near the banks of the Rhone, the Weser and the Elbe, in Russia and Poland, and in the rivers which flow into the Caspian Sea, as well as America, although differing in one important respect—viz., in the building of its house. Until very recently, it was supposed that the European species did not build its habitation like the American beaver, but burrowed along the banks of rivers. It is, however, now known that the American beaver living near the settlements acts in precisely the same manner as its European brethren, and, moreover, that in certain places which are secluded, the latter build their houses after the fashion of their transatlantic friends. At some remote period, beavers are supposed to have been common in Scotland; and tradition implies that Beverley, in Yorkshire, took its name from the circumstance of beavers abounding in the neighbouring river Hull. Giraldus Cambrensis briefly alludes to the Welsh beaver in the 12th century. Indeed, considering all the evidence, traditionary and recorded, there is little doubt that the beaver at one time was common in Britain, and recent efforts have been made to re-introduce it. Fossil remains of beavers, apparently of the same species as those now existing, are found in the deposits of the Pliocene and Pleistocene periods.

Beaver-Tree. (*See* MAGNOLIA.)

BEBEERU OR BIBIRI. (*See* NECTANDRA.)

BECCAFIGO, OR BECCAFICO, *bek-ka-fee'-ko* (Ital., the fig-pecker), the *Sylvia hortensis*, is a migratory song-bird, which feeds upon insects, figs, currants, and other fruits. It is very nearly the size of a linnet. During the summer it is a visitor to England, and even Scotland; but it always departs for a southern climate in September. Its voice resembles that of a nightingale; it lurks shyly in the thickest foliage, whence its piercing notes issue, though the tiny warbler is seldom seen, and flies with singular grace. With the ancient Romans it was a highly prized morsel, and in our own day it is one of the rarest autumnal delicacies of the Italians, the Greeks, and the French. The term beccafico is applied rather indiscriminately to different kinds of the *Sylviadæ*, or Warblers, when they are fat enough to serve at table. Birds of this kind are commonly named in France *bec-fin*.

BED, in Geology, the term usually applied to a stratum of considerable thickness, and of uniform homogeneous texture; as "bed of sandstone," "bed of clay," &c. Originally, however, the term *bed* referred to the surface-junction of two different strata.

BED-STRAW, (*See* GALIUM.)

BEE, *be* (Ang.-Sax.)—Under this name, in England alone, are included about 250 species of insects of the order *Hymenoptera*. The name *Anthophila* (flower-loving), or *Mellifera* (honey-bearing) is given to the family they constitute; and there is a subdivision into *Andrenetæ* and *Apiariæ*. The former are solitary in their habits. The females construct their nests underground in a singular manner. Usually selecting a sandy situation, they burrow in the ground to the depth of about eight or nine inches. This hole, which is cylindrical, is only of sufficient dimensions to admit the bee. The bottom, with the aid of some glutinous substance, is made tolerably smooth. This labour accomplished—and, considering the soil is only removed a grain at a time, it is no small labour—it sets forth in search of pollen. This the bee procures from flowers, and carries to her cell on her hind legs, which are thickly covered with long hairs. With the addition of a little honey, the pollen is made into a small paste-ball, in which the egg is deposited, and the mouth of the cell hermetically sealed. In time the egg becomes a larva, and devours the pollen in which it has been enveloped; the larva turns to a pupa, and then the next transformation produces a bee. It, however, remains in a torpid state till the next year. The *Apiariæ* are a more important group; and the habits of the species belonging to it are more variable than those of the *Andrenetæ*. To this group belongs the hive or honey-bee, which demands particular attention. In the earliest records may be found notices of this insect. Xenophon, who lived more than 2,000 years ago, and who is famous for his remarkably clear and perspicuous narrative, makes particular mention of it in connection with the injury his men received by eating honey of bees which had fed on deleterious plants. Both Aristotle and Virgil were observers of its habits. Pliny tells us that the philosopher Aristomachus spent fifty-eight years in investigating bee-nature; and Philiscus devoted the whole of his life to this branch of study. A beehive contains three classes of inhabitants—the *working-bees*, the *drones*, and the third order, represented by only one member —the *queen-bee*. The first class is the most important. They are believed to be undeveloped females; consequently, incapable of taking part in the reproduction of their species. The drones are the males, and exist but for the propagation of their kind. The queen-bee is the *mother-bee* of the whole colony, and lays about 200 eggs a day through the whole season, from early spring to September. The anatomy of the working-bee forms one of the most interesting portions of entomology. Its body is about half an inch in length, of a blackish-brown hue, and is covered with thick hairs, which serve the insect for the purpose of collecting pollen. The most singular part of the body is that which is called the *proboscis*. This instrument, if casually observed, appears to be a single tail, and formerly it was considered so to be by naturalists. Examined through the microscope, however, it appears a slender projection composed of some forty cartilaginous rings, fringed with fine hairs. It is formed of five parts, a central stalk, and four lateral ones—two on each side. The central part used for collecting honey, is aided by the fringed hairs lapping up, like a tongue, anything to which the proboscis is applied, and then conveyed to the pharynx, or honey-bag, whence, in due time, it is disgorged into the cells of the comb. The structure of the other portions of the mouth are beautifully adapted to their several uses. The bee has three pairs of legs, the anterior ones being the shortest, and the posterior the longest. The latter have a cup-like cavity on the fore-leg, which the bee uses to contain the pollen it collects. The legs are all covered with hairs, and more particularly the ones which carry the pollen. There is a pair of hooks attached to each foot, which enable the bee to walk on the roof of the hive. It was clearly demonstrated by Huber that respiration was as essential to the bee's existence as that of any warm-blooded animal. Situated behind the wings are *spiracles*, or air-openings, which admit air for the purpose of oxygenating the circulating system. That these *spiracles* were the instruments of respiration, Huber proved by immersing a bee in water; so long as the air-openings were free, the insect lived; immediately they were placed under water, the bubbles which escaped from them proved their use, and the bee ceased to exist. The abdomen contains the honey-bag, the stomach, the wax-bag, the venom-bag, and the sting. The honey-bag, though occasionally called the first stomach, is not used for the purpose of digestion; it is a small bag, about the size of a pea, with two pouches behind, and is properly only an enlargement of the gullet. This receptacle receives the honey from the proboscis, as already stated. A small passage thence leads to the stomach, which receives and digests the food of the bee. It was formerly supposed that the wax of the bee was the pollen elaborated in the stomach, and afterwards ejected by the mouth. The celebrated anatomist, John Hunter, discovered two small pouches in the lower part of the abdomen; and it was found that the wax is derived from the saccharine matter consumed by the bee, and that it is secreted from vessels on the surface of these pouches. After the wax has remained there for a time, it appears externally in scales, usually eight in number, below the medial rings of the abdomen, and is removed by the bee itself or one of its fellows. One of the most important and beautifully developed organs is the *sting*, which lies close to the abdomen. Viewed through the microscope, it presents one of the most elaborate and exquisitely defined pieces of mechanism to be found in the wondrous workshop of Nature. It consists of two long darts, adhering longtitudinally, and protected and encased by one sheath. The fineness of this apparatus may be shown by the fact that the sheath itself, which is not nearly so sharp as the darts, placed under a magnifying lens exaggerating its proportions some two hundred fold, is, towards the point, quite invisible. When wishing to use the sting, the sheath is first protracted and inserted; then the two fine darts follow, and are also inserted. The puncture being made, the poison is conducted in a groove to the end of the sheath. And now the most singular part of the business follows. The long darts are armed with nine or ten barbs at the end, and this prevents them from being too quickly withdrawn. Immediately the poison flows in, the darts are withdrawn, and the deadly liquid has a cavity to enter, which soon festers, and produces death. The nature of the poison is not known; it possesses, however, a certain acidity, which will redden vegetable blues. With regard to the other senses of the bee, the evidence is far from satisfactory. It has five eyes in all—three on the top of the head, and two in front. Springing from between the latter are two tubes, curving outwards on each side: these are called the *antennæ*, and serve the insect for the ordinary purposes of vision. The *antennæ* are extremely sensitive, and, indeed, the most useful organs of the bee. By their aid it builds its cells, feeds the young, and stores the hive. They are also used as a medium of recognition with its kind. The combs of a beehive comprise a congeries of hexagonal cells, built by the bees as receptacles for honey and for the nurseries of their young. Each comb in a hive is composed of two ranges of cells backed against each other: the base, or partition, between the double row is so disposed as to form a pyramidal cavity at the bottom of each. There is a continued series of these double combs in every well-filled hive, the spaces between them being just sufficient to allow two bees, one on the surface of each comb, to pass without touching. Each cell is hexagonal, the six sides being perfectly equal. This figure insures the greatest possible economy of material and space. The outer edges of the cells are slightly thickened, in order to gain strength. The same part is also covered with a beautiful varnish, which is supposed to give additional strength. The construction of several combs is generally going on at the same time. No sooner is the foundation of one laid, with a few rows of cells attached to it, than a second and a third are founded on each side, parallel with the first; and so on, till the hive is filled, the combs which were commenced first being always in the most advanced state, and, therefore, the first completed. The design of every comb is sketched out, and the first rudiments laid, by a single bee. This foundress bee forms a block out of a rough mass of wax, drawn partly from its own resources, but principally from those of other bees, which furnish wax from small sacs, in which it has been secreted, that are situated between the segments of the body of the bee, taking out the plates of wax with their hind-feet, and conveying it with their fore-feet to their mouths, where it is moistened, and rendered soft and ductile. The mass of wax prepared by the assistants is applied by the foundress bee to the roof or bottom of the hive, and thus a slightly double convex mass is formed. When of sufficient size, a cell is sculptured on one side of it by the bees, who relieve one another in the labour. The cells intended for the drones are considerably larger, and more substantial than those of the workers, and being formed subsequently, they usually appear nearer the bottom of the comb. Last of all are built the royal cells for the queens: these are situated in the very centre of the hive, and number from three to twelve. When the cells are ready, the queen begins to lay her eggs. The fecundation of the queen-bee is very extraordinary. It has been pretty clearly ascertained that no connection takes place with the drones *in the hive*. The question naturally arises, why this large number of drones in a hive? Huber's investigations have, to a certain extent, cleared away the mystery. According to this eminent naturalist, fecundation takes place by contact in the air; and it is consequently essential that the number of drones should be large, that the queen-bee may be sure of meeting them when going abroad. One intercourse is sufficient to render the queen-bee fruitful for two seasons. It is estimated that she gives birth to 100,000 bees in a single season. The eggs which are to produce working-bees are laid first. These are carefully watched; and, when they are hatched, the larva is fed with mixed honey, pollen, and water, by what are called *nurse-bees*, whose whole work is to *nurse* the young bees. Not until eleven months have elapsed in laying working-eggs, does the *mother-bee* commence laying the male and royal eggs. The *nursing* of the latter is managed on a grand scale. The royal larva disdains simple honey or pollen; it must have rich *jelly*, and in such quantities that her highness's cell is saturated with it. This waste is rather contradictory of the bee's frugality; but bees are wonderfully loyal creatures. From the egg to her majesty bee, the whole time occupied in the metamorphosis is about sixteen days. It is a remarkable fact, only recently demonstrated, that the queen-bee has the power of laying eggs without the intervention of a male, and these eggs laid by an unimpregnated virgin-bee become drones. If the queen-bee is not impregnated before she is twenty-one days old, she becomes incapable of impregnation, and lays only drone eggs for the rest of her life. The bees only require one queen at a time. So these newly-hatched majesties must be kept confined until the throne is vacant. There is also another important reason why they are not set at large. When two queen-bees meet it is certain death to one. The queen of a hive appears to be terribly jealous of the royal infants, and makes desperate efforts to destroy them; but the working-bees surround her, and keep her out of mischief, and the particular object of her jealousy, the "young queen," is also carefully guarded. The queen then becomes restless, the bees are divided into parties, one taking the part of the reigning monarch, and the other supporting the young claimant. At length the queen abdicates, is released from her cell, and with a large following of faithful attendants, quits the hive to seek a new habitation. This exodus is known as *swarming*. The throng of bees, forming a compact, buzzing cloud, at length settles on a bush or on the top of a tree. Sometimes they settle on the grass near the old hive. The bee-owner follows them with a new hive, which he endeavours to place over them. A great clatter is made with shovels, pokers, frying-pans, and other available instruments of noise, and the bees, frightened by the clamour, allow themselves to be secured. A full healthy hive will throw off two, and sometimes three swarms in the course of the summer, the first swarm being always the most valuable, on account of the bees having had the whole summer to collect their stores, which is called very often by the sellers *virgin honey*, while the late swarms often require to be fed in winter. Sometimes the first swarm throws off one from itself, which is called a *cast*, and the produce of this is the true *virgin honey*, but it is only in exceptionally favourable seasons that a cast can collect sufficient honey to carry the hive through the winter without feeding. Perhaps the most singular phenomenon in bee history is the *making of a queen*. On extraordinary occasions, when the hive by some accident is deprived of a queen, and destitute of royal larvæ, a wonderful provision is resorted to. One of the working-larvæ is selected, deposited in a royal cell, fed on the same food which is administered to the royal larvæ, and it ultimately becomes a queen. The only explanation that can be given is, that the peculiar food provided has the effect of rendering the honoured insect fertile. Towards the beginning of August, a good stock of eggs having been laid, the drones are no longer required; and winter, long and dreary, is before the industrious bees. What must be done with the lazy ones? They are massacred by the workers. A buzzing commences in the hive; the heavy drones and the nimble workers grapple and hug; but the strength of the lazy drones avails them nothing; the sharp stings of the workers' pierce them through and presently the ground is heaped with the slain. The working-bees are partially torpid in cold weather, and consume very little food; but they are readily aroused from this state.

Varieties of Bees.—About 250 species of bees are known as natives of Britain, and bees are found in almost all parts of the world, particularly in warm climates. The Ligurian, or Yellow Alp bee (*Apis Ligustica*) has been recently introduced into this country, and is reported to be less sensitive to cold than the ordinary black bee; the queens also are more prolific, and they swarm earlier and more frequently. This bee is a mountain insect; it is found between two mountain chains to the right and left of Lombardy and the Rhætian Alps, comprising the whole territory of Tessin, Vethin, and South-Graubunden. It thrives up to the height of 4,500 feet above the level of the sea, and appears to prefer the northern clime to the warmer, for in the south of Italy it is not found. The further one goes from the Alps, the less handsome it is found—as, for example, in Nice—until it is entirely lost, in Lower Italy, in the black species. The heath-bees, common in some parts of England, and met with in Schleswig and Holstein and other places, although closely resembling the black European bee in appearance, never seem to complete their labours in accumulating a store of honey, and having a well-governed community, with a queen at its head, appearing to consist principally of drones, which move about in the aimless manner peculiar to drones in an ordinary hive, which we shall refer to again. The Carniolan variety appear to be of the same genus as the ordinary black European honey-bee, with the exception that the rings on the abdomen are whiter in colour than the marks on the ordinary honey-bee. The Greek, or Crecopian, are of an order which seem to partake of a cross between the Italian, as they are commonly designated, and the black European bee. They are said to be more indefatigable than the common bee, the drones being somewhat smaller in size. The Cyprian and Smyrnæan bees appear to be also a mixed race, such as would result from the union or grafting of a Ligurian queen to a common stock, of which we shall speak again. Egyptian bees (*Apis fasciata*) appear to be the same variety as the common black honey-bee, only somewhat smaller in size, and having small white hairs about them, the first two-and-a-half rings of the abdomen being of a reddish-yellow colour, the queen being remarkably handsome. Wild honey-bees generally make their nests in hollow trees, or among the branches of trees, sometimes under ledges or in clefts of rocks; and their stores of honey afford food to numerous animals, some of which also prey upon the larvæ.

The Humble-bee derives its name from the humming noise produced by the wings when in motion. There are about forty different species of humble-bees in Great Britain. They are larger than the ordinary hive-bee; their communities are not so large, and the females are not so prolific. One species (*Bombus terrestris*) make nests in holes in the ground, at the depth of about a foot, floored with leaves and lined with wax, and often entered by a winding passage; another species (*B. lapidarus*) among stones; and a third (*B. muscorum*) in moss. Humble-bees do not swarm, the females do not seek to destroy each other, and the males and workers die on the approach of winter, the females remaining in a torpid state until the ensuing spring, when they lay eggs and found new communities. In rural districts, the name is often perverted into "Bumble-bee."

Solitary Bees, or those which do not live in communities, have no neuter sex, or working-bees; there are only perfect males and females. They make nests in holes of the ground, or by excavation in old wood. One European species (*Xylocopa violacea*) drills holes, or tunnels, twelve or fifteen inches long, divided into ten or twelve cells, in each of which an egg, with a store of pollen and honey for food, is deposited. The soft pith of brambles is, by some of these bees, scooped out to make room for a nest, and oak-galls, and even snail shells, have been known to be made available; and one species (*Megachile muraria*) glue together grains of sand, with a viscid saliva, as a covering to their nests, and the compound is so hard as not to be easily penetrated by a knife.

BEECH. (*See* FAGUS.)

BEE-EATER, *be-e'-ter* (*Merops apiaster*), a genus of birds of the order *Insessores* and tribe *Fissirostres*, nearly allied to the King-fishers. They are found in large numbers in the southern and eastern provinces of Europe and the northern districts of Africa. They build their nests in clay and sand banks, and associate so closely together that the earth appears like a honeycomb. There is some analogy between these birds and the swallows; indeed, in the neighbourhood of the Cape, where they most abound, they are called by the Dutch mountain swallows. In certain parts of Africa, they are much respected by the natives, who have a belief, that by following one of them, the discovery of a store of honey will be the certain result. They are larger than the common swallow, and have a long and slightly-curved beak. Their colour is a blending of white, and brown, and green.

BEEF. (*See* FOOD, ANIMAL.)

BEEF-EATER, a genus of birds only found in Africa. This bird belongs to the order *Insessores*, tribe *Conirostres*. They have short bills, swelling towards the point, and square at the base. They subsist upon the larvæ of gadflies, which they find in the hides of buffaloes, camels, and other large quadrupeds. They perch upon the back of these animals, and Dr. Livingstone states, with regard to one of the species—the buffalo-birds, that as their sight is keener than that of the buffalo, they see the approach of danger first. When the buffalo perceives that the birds are flying away, he is warned that he is in peril, and begins to look around him. The beef-eaters are sometimes called ox-peckers.

BEEF WOOD. (*See* CASUARINA.)

BEESHA, *be'-sha*, a genus of grasses nearly allied to the Bamboo, but differing from it in having the seed enclosed in a fleshy pericarp. Only a very few species are known, all natives of the East Indies

BEET. (*See* BETA.

BEET-FLY (*Anthomyia Betæ*), an insect not so large as a common fly, which deposits its eggs on the leaves of beetroot, or mangel-wurzel. When the larvæ leave the eggs, they devour the soft parts of the leaves, giving the plant a scorched and blistered appearance. It is a dipterous or two-winged insect of the great family *Muscides*, the type of which is the common house-fly, and belongs to a genus whose larvæ infest and feed upon the roots of cabbages, turnips, &c. (*See* CABBAGE-FLY, TURNIP-FLY, POTATO-FLY.)

BEETLE, *bee'-tl*.—This term is frequently used to designate the large tribe of insects called *Scarabæides*, but it is more frequently and correctly used as the name of those insects which are covered with a strong horny substance, and have the abdominal part of the body guarded by two sheaths, under which the wings are folded. Hence the word is often used in works on natural history as the ordinary designation for coleopterous insects. This, however, is not correct, as it would bring under the title of Beetle, cantharides, weevils, fire-flies, &c. (*See* the articles COLEOPTERA, SCARABÆIDES, STAG-BEETLE, TIGER-BEETLE, BOMBARDIER-BEETLE, BURYING-BEETLE, GOLIATH-BEETLE, ROSE-BEETLE, &c.)

BEETLE-STONES.—In a cliff composed of shale, at Newhaven, as well as upon the beach in the vicinity, there are found certain indurated nodules of clay iron-stone. These minerals are selected by the lapidaries of Edinburgh to be fashioned into articles of ornament; as, letter-weights, &c. When highly polished, these stones present a very attractive appearance. The term is said to have owed its origin to a fancied resemblance of the nodules to a fossil beetle. Although some of these minerals exhibit proofs of an animal origin—a fossil fish, for instance—the nucleus of the nodules is never that of a fossil beetle.

BEGONIA, *be-go'-ni-a* (so named after Michel Bégon, a French botanist), the typical genius of the natural order *begoniaceæ*. The species (about 160 in number) are natives of tropical regions, but many are now cultivated as ornamental plants throughout Europe. The leaves are oblique or unequal (more developed on one side of the midrib than on the other), and are often richly tinged with crimson. The flowers are of a delicate pink colour, and grow in cymes. The young stems and leaves of the species *B. malabarica* and *tuberosa* are used as potherbs in the countries where they grow wild. Of the numerous species which adorn our conservatories, *B. argyrostigma* and *discolor* are perhaps the most beautiful. The first of these, the silver-spotted begonia, was brought to this country from Brazil in the early part of the present century; the leaves, which are long and pointed, are red beneath and spotted with white above. *B. discolor*, or two-coloured begonia, is a Chinese species, and is remarkable for the very rich crimson of the under-surface of the leaf, which is short and broad.

BEGONIACEÆ, *be-go-ni-ai'-se-e*, the Begonia family, a natural order of dicotyledonous plants belonging to the sub-class *Monochlamydeæ*, consisting of four genera and 160 species, natives chiefly of India, South America, and the West Indies. The species are herbs, or low succulent shrubs, with alternate leaves which are oblique at the base and have large dry stipules. The flowers, which growi n cymes, are unisexual, the perianth coloured with four unequal divisions in the male flower, and five or eight in the female. The stamens are numerous; the fruit is membraneous, winged, three-celled, bursting by slits at the base; the seeds are very small. The plants are more remarkable for their handsome leaves and neat flowers than for useful properties. They are reputed, generally, to possess astringent and bitter qualities, and occasionally to be purgative.

BEJAN, OR BAJAN, *be'-jan* (Fr., *bec-jaune*, yellow beak, an unfledged bird), a nickname given to new students, or freshmen, in some of the Scotch and many continental universities.

BELEMNITES, *bel'-em-nites* (Gr., *belemnos*, a dart), fossil remains of extinct naked cephalopods allied to the squid and the cuttle-fish. They are found in large numbers in the chalk and oolite, generally as straight, solid, dart-like stones. These relics of creatures which thronged the seas of the secondary period have ever been objects of wonder, and the wildest speculations have been advanced to explain their origin. The popular names for them, such as devil's fingers, spectre-candles, arrow-heads, picts, and thunderbolts, indicate the different views taken of their nature by the ignorant. To the philosophers of the last century, the belemnite was a standing puzzle, and the guesses which were called forth from time to time appear to us to be scarcely less absurd than the popular beliefs. It was said to be a product of electric action, and given the learned name of *lapis fulminans*, or thunder-stone. According to other hypothesis it was a stalactite, a crystal, petrified amber, and lastly, when fossils began to be looked upon as actual organic remains, it was held to be the tooth, or perhaps the spine, of some unknown creature. It is now known to be the internal bone or shell of a cephalophod, and corresponds to the slender and insignificant *pen* of the common squid. Although the most common belemnites are mere tapering stones, some have been found so well preserved that naturalists have been able to form from them a vivid image of the living mollusc. "The belemnite," writes the author of "Vestiges of Creation," "is an elongated conical shell terminating in a point, and having at the larger end, a cavity for the residence of the animal, with a series of air-chambers below. The animal placed in the upper cavity, could raise or depress itself in the water at pleasure, by a pneumatic operation upon the air-tube pervading the shell. Its tentacula sent abroad over the summit of the shell searches the sea for prey. The creature had an ink-bag, with which it could muddle the water around it, to protect itself from more powerful animals; and, strange to say, this has been found so well preserved that an artist has used it in one instance as a pigment wherewith to delineate the belemnite itself." One genus of the belemnite family, called *Belemnoteuthis*, and occurring in the lias and oolite, is occasionally discovered with the remains and impressions of the soft parts; namely, the mantle, body, and tentacles.

BELLADONNA, *bel-la-don'-na*. (*See* ATROPA.)

BELLADONNA LILY, a very beautiful species of *Amaryllis* (which *see*). It is a native of the Cape of Good Hope, and was introduced into England in the early part of the last century. The flowering-stem is about eighteen inches in height, and bears at its summit a cluster of drooping flowers of a delicate rose-colour.

BELL-BIRD (*Arapunga alba*), a native of Guiana, South America, and distinguished by a fleshy tubular appendage above the base of the bill of the male bird. When empty, this tube, about three inches long, is pendulous, but it can be filled with air by a communication from the palate, and then rises erect. Generally, this appendage is decorated with a few fine feathers. Its voice is very peculiar, and much resembles the tolling of a bell. Waterton asserts that the sound it emits may be heard at a distance of three miles. The bird is of a pure white colour, and about a foot in length.

BELLE-DE-NUIT, *bel'-de(r)-nwe* (Fr., beauty of night), the name given by French travellers to some tropical species of *Convolvulaceæ*, with extremely beautiful and fragrant flowers, which open only at night time. They are natives of the West Indies and South America. (*See* MIRABILIS, CONVOLVULUS.)

BELLEROPHON, *bel-ler'-o-fon*, a genus of fossil shells occurring in the Silurian, Devonian, and Carboniferous strata. As in the existing argonaut, the shell consists of a single chamber.

BELL-FLOWER. (*See* CAMPANULA.)

BELLIS, *bel'-lis*, the Daisy, a genus of plants belonging to the natural order *Compositæ*, sub-order, *Corymbiferæ*. The receptacle is without scales, and upon it are arranged two kinds of flowers—ligulate, or strap-shaped, and tubular. The ligulate flowers, which are white in the common daisy, form the ray, or outer circle. They have no stamens, but each has a single pistil, which, at the top, divides into two branches, forming stigmas. The yellow tubular flowers clustered together within the ray are hermaphrodite; that is to say, they have both stamens and pistils. The involucre is composed of two rows of bracts. The fruit found at the base of every little flower, whether ligulate or tubular, is without a pappus, and contains a single seed. The best known species is *B. perennis*, the common daisy. The roots of this are perennial. It blossoms nearly all the year round, and is constantly found with open flowers from March to October. Few of the poems of Burns are better known and admired than his address to the daisy, the "wee modest crimson-tipped flower."

BELLY. (*See* ABDOMEN.)

BELOPTERA, *be-lop'-te-ra* (Gr., *belos*, arrow, *pteron*, wing), a fossil resembling a belemnite, but less pointed, and having a wing-like projection or process on each side. It occurs in tertiary strata, and was evidently the internal bone of a cephalopod. The name *Belosepia* (Gr., *sepia*, cuttle-fish) is given to another kind of belemnite found in tertiary deposits; and that of *Beloteuthis* (Gr., *teuthis*, squid) to one shaped like a spear-head occurring in the lias.

BELUGA, *be-lu'-ga*, a genus of *Cetacea*, belonging to the *Delphinidæ*, or Dolphins. It has a broad blunt head, and no produced snout; thus differing from the rest of the family to which it belongs. Its form is principally characterized by the softness of its curves, and the clear white colour of its skin, which is so tender that it often fails to retain the harpoon. The beluga also differs from the ordinary family of dolphins in having fewer teeth, which fall out before the animal is old, and it has no dorsal fin. It usually attains the length of thirteen feet. It is gregarious, and shoals of fifty or sixty are often met with in the Arctic seas. Belugas have been captured on the coast of the British Isles; and, in 1846, one was killed in the Medway. The Greenlanders eat the flesh, and convert the skin into leather. The oil is of very fine quality.

BELVISIACEÆ, *bel'-vis-i-ai'-se-e* (from the genus *Belvisia*, named after its discoverer, P. de Beauvois), a small natural order of dicotyledonous plants, in sub-class *Calycifloræ*, comprehending only two genera, namely *Asteranthos* and *Napoleona*, or *Belvisia*. These include four species, which are large shrubs, with smooth leathery leaves, all growing in tropical Africa. The flowers grow in threes, sessile in the axils of the leaves, and are extremely curious. The calyx is a thick leathery cup, divided into five segments. The corolla consists of three distinct whorls of united petals; the outer one turning back over the calyx; the second one is a narrow membrane divided into numerous segments; and the third forms an erect cup, and contains the stamens, which are united, so as to make a sort of inner cup. The fruit is a soft berry, with large kidney-shaped seeds. The pulp of the fruit is edible, and the pericarp contains much tannin.

BEMBECIDÆ, *bem'-be-si-de*, a family of hymenopterous insects, commonly known as sand-wasps. They resemble wasps in appearance, and some are remarkable for emitting an odour similar to that of roses. The females are furnished with stings.

BEMBRIDGE BEDS, *bem'-bridj*, the name given to an important group of upper eocene strata, resting on the Osborne or St. Helen's series, and capped by the Hempstead beds. In the Isle of Wight this group is principally developed. Beginning at the bottom, we find the Bembridge limestone. This bed consists of a pale yellow or cream-coloured limestone, interstratified with clay or crumbling marl, and is from 20 to 25 feet thick. Upon this we find the oyster-bed, a few feet of greenish sands, containing oysters (*Ostræa vectensis*) in great abundance, capped by a band of hard septerian stone. Resting on this are unfossiliferous mottled clays, alternating with fossiliferous laminated clays and marls. The latter contain the characteristic shell *Cyrena pulchra*. Lastly, we come to marls and laminated grey clays containing *Melania turritissima*; for immediately above these we find the *black band*, forming the base of the Hempstead series.

BENJAMIN TREE. (*See* BENZOIN.)

BENT GRASS, the common name for the genus *Agrostis* (which *see*.)

BERBERIDACEÆ, *ber'-ber-i-dai'-se-e*, the Barberry family, a natural order of dicotyledonous plants, in the sub-class *Thalamifloræ*, consisting of shrubs and herbaceous perennials. The order includes twelve genera, which together contain 100 species, natives of the temperate parts of Europe, Asia, and America, some being exceedingly common in the mountainous regions of the north of India. The plants have acid, astringent, and bitter properties; their acidity is due to the presence of oxalic acid.

BERBERIS, *ber'-be-ris*, the typical genus of the natural order *Berberidaceæ*, consisting of numerous species, found in temperate climates in most parts, except Australia. The most interesting species is *B. vulgaris*, the common barberry, which is usually a bush from four to six feet high, but which, in Italy, sometimes becomes as large as a plum-tree. It is a very ornamental plant, especially when covered with fruit. The berries are of an oval shape, and, when ripe, generally of a bright-red colour, but sometimes whitish, yellow, or almost black. They are very acid, and not fit to be eaten raw; but when boiled with sugar, they form a most refreshing preserve. They are sometimes pickled, to be used for garnishing dishes, and occasionally they are put into sugar-plums or comfits. The bark and stem are very astringent, and yield a bright yellow die. Of the numerous species of *Berberis* which are cultivated in Britain as ornamental shrubs, the finest is *B. aristata*, the bristle-leaved barberry. This is a hardy evergreen, producing excellent fruit. It is a native of Nepaul.

BERGAMOT, *ber'-ga-mot*, the popular name of nearly fifty different kinds of pears. The one best known is the *Bergamot Crasanne*, a flattish, rough-skinned pear, with a very juicy pulp and agreeable flavour.

BERG-MEHL, *bairg'-mal* (Swedish, mountain-meal), the name given to a whitish earth, consisting almost entirely of the flinty shields of microscopic plant-growths. (*See* DIATOMACEÆ.) It occurs in bog and ancient lake deposits in many parts of Northern Europe, and, during times of great scarcity, it has been, mixed with flour, eaten as food. The amount of nutriment contained in it is very minute.

BERNICLE GOOSE, *ber'-ni-kl*. The bernicle goose (*Anser bernicla*, or *leucopsis*), is marine in its habits, and feeds almost entirely on algæ and grass-wracks. Like the common goose, it is only a winter visitor to our climate, and passes during the summer to the highest northern latitudes. The bird owes its name to a ridiculous notion. It was formerly believed (it can scarcely be said that the belief is to this day entirely abandoned) that these birds were produced from the common bernacle, or barnacle, the latter originating, in their turn, from the fruits of a particular tree, whose branches dipped into the water. It is smaller than the common goose, has the forehead, cheeks, and throat white, and the bill black, with a black stripe extending to the eye. The crown of the head, the neck, and the upper part of the breast are black. The plumage on the upper part of the body is chiefly ash-grey and black in undulating bars. (*See* GOOSE.)

BERÖE, *be-ro'-e*, a genus of *Acalephæ*, of higher organization than the Medusæ. The beröe are characterized by a nearly globular or oval body of a jelly-like substance. On the body are bands covered with rows of large cilia, the rapid motion of which is controlled by the will of the animal, and causes a beautiful iridescence. The *Beröe pileus*, a beautiful little creature, is very abundant off the British coasts. It has two long slender tentacula, covered with fine filaments.

BERRY, a description of fruit more or less fleshy and juicy, and not opening when ripe. (*See* BACCA.)

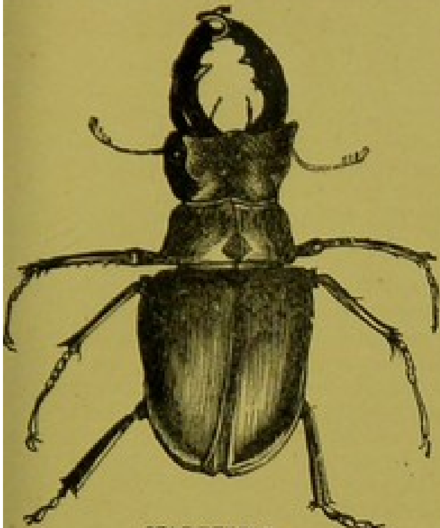
BERTHOLLETIA, *ber-tol-le'-ti-a* (so named in honour of Berthollet, the French chemist), a genus of plants belonging to the natural order *Lecythidaceæ*. The only species known is *B. excelsa*, a majestic tree, growing to the height of 100 or 120 feet, which forms vast forests on the banks of the Orinoco. (*See* BRAZIL NUTS.)

BERYL, *be'-rel*, a mineral which in many respects resembles the emerald, but is of a yellowish or blue colour, and somewhat harder. The finer varieties, transparent and of beautiful colour, are known as precious beryls or aquamarines (*See* AQUAMARINE), and occur in crystals or modified hexagonal prisms. Beryl occurs most frequently in veins that traverse granite or gneiss, or imbedded in granite. It is found in many places in Europe; and the precious beryl chiefly in Brazil and Siberia, but occasionally in the mountains of Aberdeenshire and the Mourne mountains, Ireland, and in New England, North America.

BESSEMER FLAME, SPECTRUM OF THE. (*See* SPECTRUM.)

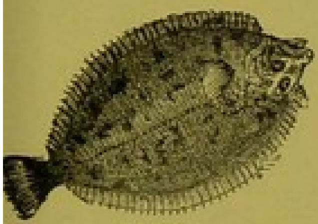
BETA, *be'-ta*, the Beet, a genus of plants belonging to the natural order *Chenopodiaceæ*, found in Europe, the north of Africa, and the western parts of Asia. *B. vulgaris*, the common beet, grows along the whole coast of the Mediterranean, and is cultivated in European gardens for its sweet, tender, and dark-red root, which is chiefly used in England as a salad, but in France and Germany as a common table vegetable. It is also cultivated on a large scale in many parts of the world as a source of sugar; and it is believed at the present time that about 1,200,000 tons of beetroot sugar are annually produced in Europe. (*See* SUGAR.) The beet used for this purpose is considered to be a variety of *B. vulgaris*, and is known as the sugar-beet. The mangel wurzel, so valuable as a field-crop for feeding cattle, is another variety and is distinguished by botanists as *B. vulgaris*, variety *campestris*. The white beet, cultivated in gardens for the sake of its leaves, which are used as a substitute for spinach, is also merely a variety of the same plant.

BETULA, *bet'-u-la*, the Birch, a genus of trees or shrubs belonging to the natural order *Betulaceæ*. With the exception of *B. antarctica*, an evergreen shrub found in Terra del Fuego, all the species flourish beyond the tropic in the northern hemisphere. *B. alba*, the common birch, is one of the most beautiful of our forest trees, and is found in most of the northern parts of Europe, Asia, and America. Under favourable circumstances, it grows to the height of 60 or even 70 feet; but as it approaches both the northern and southern limits of its native region, it gradually decreases in size, and ultimately appears as a mere bush. The leaves are small, of an ovate-triangular shape, and doubly serrated. The bark is smooth and silvery white, and the outer layers are thrown off as the trunk increases in diameter. This tree yields useful timber for turnery, hoops, fish-barrels, cattle-yokes, and other articles in which lightness is of more importance than durability; the wood is also employed for making charcoal. The bark is valuable as a dye-stuff and for tanning, and, being exceedingly tough, is turned to a variety of uses by the poor of Northern Europe. Light boats, or canoes, are formed of it by the Russians on the Volga; it is sometimes employed instead of slates for roofing houses, sometimes twisted into ropes, and is even used for making hats, shoes, and drinking-vessels. The outer layers yield an oil which is much prized by the tanner; it is this which gives Russia leather its peculiar odour. In the spring the sap of the birch contains much sugar, and forms, when fresh, an agreeable beverage; when fermented, it constitutes what is called birch wine, a liquor employed medicinally in domestic practice for stone and gravel. The young twigs are in general use for besoms, and birch-rods were once recognised aids to education. The graceful tree known as the weeping-birch is generally regarded as a mere variety of *B. alba*; but a few botanists view it as a distinct species, and name it *B. pendula*. *B. nigra*, the black birch of North America,


STAG-BEETLE.


BAMBOO.


ERRATIC BOULDERS.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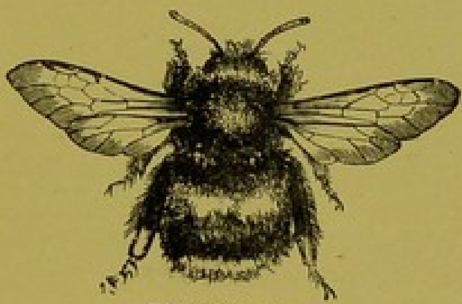
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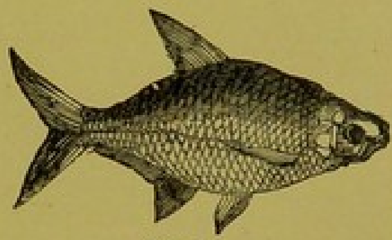
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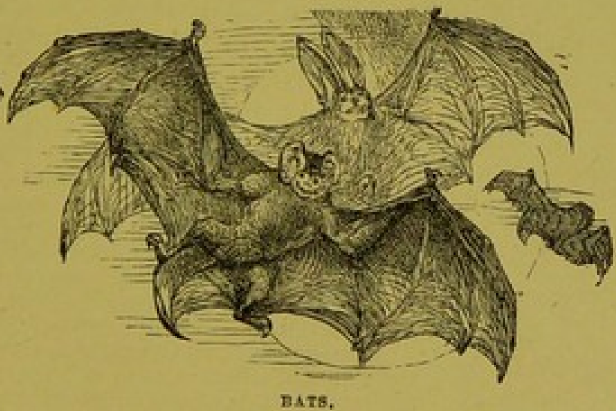

BATS.


BORASSUS PALM.


BIRD OF PARADISE


BRAZIL-NUT

yields a fine-grained valuable timber, and, like the common birch, a saccharine juice. *B. papyracea*, the paper birch, is a native of the more northern regions of the same continent; it is remarkable for its tough bark, which is used by the Indians as a substitute for paper, and for constructing canoes, boxes, and baskets. *B. excelsa*, the yellow birch of North America (Maine, Nova Scotia, New Brunswick, &c.), is a very beautiful tree attaining a height of 70 to 80 feet, and destitute of branches for about 30 feet. The bark is of a brilliant yellow colour, and the leaves are very large. The wood is used for ship-building purposes. *B. lenta*, another American species, commonly known as the cherry-birch, yields the timber called mountain mahogany: its bark is one of the sources of the volatile oil called oil of winter green. (*See* GUALTHERIA.) The bark of the Asiatic species, *B. Bhajaptraut* (growing on the Himalayas, sometimes at an elevation of 9,000 feet) is used in India as paper, and for lining the tubes of hookahs.

BETULACEÆ, *bet-u-lai'-se-e*, the Birch family, a natural order of dicotyledonous plants, in the sub-class *Monochlamydeæ*. All the species are either trees or shrubs. The flowers are unisexual, the fertile being in one catkin, and the barren in another. In each, small scales take the place of a true calyx. The fruit is dry, indehiscent, and one-celled, with a single seed. There are but two genera, *Betula* and *Alnus* (which *see*), and about sixty-five species, almost all natives of the colder regions in the northern hemisphere. Many of these are very valuable either for their timber, or for their astringent, tonic, and febrifugal barks.

BEZOAR STONES, *be'-zor* (Persian, *pazahar*, antidote to poison), concretions found in the stomachs of various animals. They are brittle egg-shaped masses, about the size of a small walnut, and are mostly dark olive in colour. On being cut open, they present the appearance of a nucleus surrounded by concentric deposits. They occur principally in the stomachs of oriental goats, deer, and antelopes, and were formerly looked upon as possessing supernatural properties, being able to cure all diseases, and act as antidotes against every poison. They were so much sought after as to be worth ten times their weight in gold. The most valuable of these was obtained from the wild goats of Persia, and was called the *Lapis Bezoar Orientalis*. They are found, more or less, in all herbivora, and sometimes occur in the stomachs of persons living much on farinaceous food. They contain litho-fellic and ellagic acids.

BHANG, *bang*, the common Indian name for the seed-capsules and larger leaves of the native hemp employed for making the celebrated narcotic called *Haschisch* (which *see*). The Indian hemp is a species of the genus *Cannabis* (which *see* also).

BIBIRU. (*See* NECTANDRA.)

BICAPSULAR, *bi-kap'-su-lar* (Lat., *bis*, twice, *capsula*, a capsule), having two capsules containing seeds to each flower.

BICEPS, *bi'-seps* (Lat., *bis*, twice, *caput*, a head), a common name applied to several muscles of the human body, from their having two distinct origins or heads. The principal of these are the *biceps flexor cruris* and the *biceps flexor cubiti*, the former situated on the hind part of the thigh, the latter on the fore part of the os humeri.

BICORNIS, *bi-kor'-nis* (Lat., *bis*, and *cornu*, a horn), is a term sometimes applied in Anatomy to the hyoid bone, from its having two processes like horns. Formerly, it was also applied to muscles that had two terminations.

BICUSPIDES, OR BICUSPIDATI, *bi-kus'-pids* (Lat., *bis*, and *cuspis*, a spear), is applied to the two first pairs of molars in each jaw, from their having two spearlike tubercles.

BIELA'S COMET, *be'-la's* (Gr., *kome*, hair), a comet discovered in the month of February, 1826, by a Prussian named Biela, at Josephstadt, in Bohemia. It accomplishes its elliptic revolution round the sun in rather more than six years and a half. It approaches the earth's orbit more closely than any other cometary body that has yet been observed. In 1846, the comet was observed to be separated into two parts, which travelled in company, at a distance of about 950,000 miles apart. It was not seen in its perihelion passage in 1859, as the circumstances attending its motion were unfavourable for its observation; but this also occurred in 1839, when it passed without notice. When last observed, in 1852, the two fragments into which it had been divided by some inexplicable means, were plainly noticed travelling onwards through space, at the same relative distance from each other as in 1846.

BIENNIAL, *bi-en'-ni-al* (Lat., *bis*, twice, *annus*, year), a term applied to a plant which springs from the seed one year, but does not flower and seed until the second year, when it perishes. The biennial root is commonly enlarged at the close of the first season by an accumulation of nutriment intended for the support of the plant during its flowering and fruiting. Under changed circumstances of soil and culture, some biennials become annuals.

BIGNONIA, *big-no'-ni-a* (named after the Abbé Bignon, librarian to Louis XIV.), the Trumpet-flower, the typical genus of the natural order *Bignoniaceæ*. The species are trees or shrubs, usually of a climbing habit, and furnished with tendrils. The leaves are opposite, and generally ternate, pinnate, or conjugate. The flowers are mostly in terminal or axillary panicles. The corollas are trumpet-shaped, and are coloured variously, white, yellow, orange, purple, or rose. All the species are magnificent plants when in blossom, and have long been cultivated by florists. They are, with few exceptions, too delicate to withstand our climate, and will only grow freely in stoves. From the leaves of the species *B. chica*, the Indians of South America obtain a red dye called *chica*, or *carajura*, which they use for painting their bodies and their arrows.

BIGNONIACEÆ, *big-no-ni-ai'-se-e*, in Bot., a natural order of dicotyledonous plants, in the sub-class *Corollifloræ*. They are usually trees or shrubs, often twining or climbing; rarely herbs. They flourish in the hotter parts of Asia, Africa, and America, being unknown in Europe except in a cultivated state. The chief interest of these plants lies in their beautiful trumpet-shaped flowers. There are about 500 species.

BIKH. (*See* ACONITUM.)

BILBERRY. (*See* VACCINIUM and WHORTLEBERRY.)

BILE, *bile* (Lat., *bilis*, said to be derived from *bis*, twice, and *lis*, contention, as being the supposed cause of anger and dispute), it is a peculiar oily fluid secreted from the blood by the liver. In man it is generally of a yellowish-brown colour, and has a bitter taste. According to Berzelius, its constituents are, in 1,000 parts, 908·4 water, 80 picromel, 3 albumen, 4·1 soda, 0·1 phosphate of lime, 3·4 common salt, and 1 phosphate of soda. The primary cells of the liver separate the bile from the blood of the portal vein, and discharge it into small ducts, which unite to form larger ones, terminating in the ductus communis choledochus, whence it is conveyed into the duodenum. It there mixes with the digested food, and performs the important office of fitting it for absorption into the system. The bile thus mixed with the elements of nutrition becomes in part also absorbed; the excrementitious portion passing out of the body, with the other indigestible materials. When digestion is not going on, the bile ascends through the cystic duct to the gall-bladder, where it is stored for future use. The principal use of the bile is to separate the chyle from the chyme. It also aids in exciting the peristaltic motion of the intestines, and thus causes them to evacuate their contents sooner than they would otherwise do; for, when there is a deficiency of bile, the bowels are in general extremely torpid. When, owing to some functional derangement, the bile is absorbed into the blood and carried through the system, it imparts a yellow tint to the surface of the skin. (*See* JAUNDICE.) The solid portions of the bile may be in excess, and solidifying, produce biliary calculi, or gall-stones. (*See* BILIARY CALCULI.) When from any cause the bile is in excess in the blood, or when the liver only imperfectly performs its function of secreting it, the person is said to be bilious. (*See* LIVER.)

BILIARY CALCULI (Lat., *calculus*, a small stone).—These are sometimes called gall-stones, and are often found in the human gall-bladder in large quantities. They are either semi-transparent and crystalline, or strongly coloured with the bile. They mostly consist of cholesterin deposited on a nucleus of phosphate of lime. (*See* CALCULIS.)

BILIARY DUCTS, those ducts or canals which convey the bile from the liver to the duodenum.

BILL, *bill* (Ang.-Sax., *bill*, a beak), the beak or hard horny mouth of a bird, consisting of two mandibles. There is no appearance of lips either in the upper or lower jaw. A portion of the bill at the base of the upper mandible is covered with a membrane, which is called the *cere*, from the waxy appearance which it presents in some species of birds. It is sometimes covered with feathers, and sometimes it is naked; but it is often found protected by hairs or bristles. The nostrils of a bird are usually situated in the *cere*, but in some cases they are placed so far forward as hardly to be observable. The bills of birds vary in shape according to their habits and the different substances upon which they feed. The bills of birds of prey are very strong, the upper part being hooked, and very sharp, so as to be able to tear and cut to pieces the flesh of the animals upon which they seize. A strong short bill, with the edges sharp and notched, is the usual indication of courage in a bird, and a sign that it preys upon living animals. The great variety in the modification of the forms of bills is very interesting, and is treated of under the names of the different species of birds; such as crop-bills, spoon-bills, horn-bills, parrots, &c. In the case of those birds which live upon insects, the bill is very seldom found hooked, but usually short and slender. The bills of those birds which catch insects flying, are remarkable for their deep division, which enables them to gape widely. Birds which live upon seeds have short but powerful bills, with which they can crush their food. Aquatic birds have, as a general rule, broad sensitive bills, which are provided with laminæ on the inner edge, for the purpose of straining the muddy water, from which they take the principal part of their food. The bills of every species of bird which extracts its food from mud, are modified according to the nature of the food it seeks. Besides the general use of tearing or crushing food, the bills of birds are used when fighting with each other, and also for the purpose of dressing their plumage, building their nests, and for other functions. Many fishes and reptiles have mouths resembling bills, and the *Ornithorhynchus paradoxus* is a singular specimen of a quadruped with a bill.

BILLARDIERA, *bil-lar'-de-air'-a* (from the French botanist Labillardière), a genus of plants belonging to the natural order *Pittosporaceæ.* The species are climbing shrubs, natives of Australia and Tasmania, where they are commonly known as apple-berries. They have simple alternate evergreen leaves, and axillary pendulous flowers. The fruits are soft berries, which, when ripe, are of a bluish colour, and have a pleasant sub-acid taste. A few species are cultivated in the conservatories of this country for the sake of their handsome flowers.

BILLBERGIA, *bil-ber'-ji-a* (from the Swedish botanist Billberg), a genus of plants belonging to the natural order *Bromeliaceæ.* The species are all natives of South America. From the roots of *B. tinctoria* the Brazilians obtain a yellow dye.

BIMANA, *bi-mai'-na* (Lat., *bis*, twice, *manus*, a hand), the first order of Mammalia, reckoning in its number the human species only; no other animal possessing only two hands. The monkey tribes are distinguished by having thumbs at each of the four extremities of their limbs, and are consequently called *quadrumana*, or four-handed animals.

BINARY ARITHMETIC, *bi'-na-re*, a kind of notation in which only unity, or 1 and 0, is used. It was the invention of Leibnitz, who proves it to be an expeditious method of discovering properties of numbers and of constructing tables. M. Dangecourt, in the History of the Royal Academy of Sciences, gives a specimen of its operation in arithmetical progressionals, in which he shows that, as in binary arithmetic only two characters are used, the laws of progression may be more easily discovered by it than by common arithmetic. In binary arithmetic, all the characters used are 0 and 1, and the cipher multiplies everything by two, as in the ordinary arithmetic is done by 10. Thus, 1 is 1; 10, 2; 11, 3; 100, 4; 101, 5; 110, 6; 111, 7; 1,000, 8; 1,001, 9; 1,010, 10. It is remarkable that this system is identical with that used 4,000 years ago by the Chinese, and left as an enigma by Fo-Hi, the founder of their empire.

Binary Compound. (*See* CHEMICAL NOMENCLATURE.)

BINARY NUMBER is that which is composed of two units.

BINARY THEORY, in Chemistry. (*See* SALTS.)

BINDWEED. (*See* CONVOLVULUS.)

BINOMIAL, *bi-no'-mi-al*, in Algebra, an expression consisting of two members, connected by the sign + or −. Thus, $a+b$ and $8-3$ are binomials, consisting of the sum and difference of these quantities. The powers of any binomial are found by a continual multiplication of it by itself. For example, the cube or third power of $a+b$ will be found, by multiplication, to be $a^3+3a^2b+3ab^2+b^3$; and if the powers of $a-b$ are required, they will be found the same as the preceding, only the terms in which the exponent of b is an odd number will be found negative. Thus, the cube of $a-b$ will be found to be $a^3-3a^2b+ab^2-b^3$; where the second and fourth terms are negative, the exponent of b being an odd number in these terms. In general, the terms of any power of $a-b$ are positive and negative by turns.

BIOLOGY, *bi-ol'-o-je* (Gr., *bios*, life, and *logos*, a discourse), is the science of life. In its widest sense, it includes life in all its forms on earth, and thus comprehends within its sphere all living organized beings. Within the last few years no department of science has been more energetically pursued, and many of the most acute intellects of the age have been engaged in the investigation of the phenomena exhibited by living matter, and the endeavour to discover an approximation to a reply to the great question, "What is life?" The phenomena of life, however, are distinct from life itself; and what life does, or produces, is not identical with what life is. Living matter, as distinct from non-living matter, has three distinctive properties—1, chemical composition, for it contains a complex compound of carbon, oxygen, and nitrogen, known as protein, which has never been obtained otherwise than from living bodies; 2, integration and waste, supplied by the formation and development of new matter; 3, tendency to undergo cyclical changes. The protein is the chief constituent of a substance known as protoplasm, which appears to be the very basis of physical life, and is found in all animal and vegetable structures; the addition of new protoplasm causes growth, not by a secretion or addition to the surface as in the case of non-living matter, but by a process described as molecular intersusception, or interposition of new matter between the existing molecules of the living mass. The cyclical changes are exhibited in the power of propagation and creating new living masses, which take the character of those from which they originated. "Thus," says a recent able writer, "an individual living body is not only constantly changing its substance, but its size and form are undergoing continual modifications, the end of which is the death and decay of that individual, the continuation of the kind being secured by the detachment of portions which tend to run through the same cycle of forms as the parent." Another distinction between living and non-living bodies is that, in nearly every known instance of the former, even the most minute, the character of which is revealed by powerful microscopes, there are visibly different parts which possess different powers or functions, and such living things are described as *organized*. That this cannot be said of all living matter is perhaps due to the deficiency of our powers of investigation, and there may be a complex molecular structure beyond the reach of vision. A mass of living protoplasm is simply a molecular machine of great complexity, the total results of the working of which, as its vital phenomena depend, on the one hand, on its construction, and on the other on the energy supplied to it. So far as science has been able to reach, the morphological, or form, unit, the primary and fundamental form of living matter, is merely an individual mass of protoplasm, in which no farther structure is discernible; and these form-units are of the nature of cells, spheroidal masses of protoplasm, surrounded, in most cases, by what is known as a cell-wall. The ultimate conclusion which has been arrived at is that no cell has arisen otherwise than by becoming separated from the protoplasm of a pre-existing cell. Here we must stop, not because there is nothing beyond, but simply because, with all the appliances at our disposal, we can see no farther, and are still without any satisfactory definition of what life is. We can, within certain limits, discover results of the primordial vital force, but only results. The development of a living organism is thus described by the writer already quoted (Professor Huxley, in the *Encyclopædia Britannica*)—"However complicated one of the higher animals or plants may be, it begins its separate existence under the form of a nucleated cell. This, by division, becomes converted into an aggregate of nucleated cells; the parts of this aggregate, following different laws of growth and multiplication, give rise to the rudiments of the organ; and the parts of these rudiments again take on those modes of growth and multiplication and metamorphosis which are needful to convert the rudiment into the perfect structure. The development of the organism as a whole, therefore, repeats in principle the development of the cell. It is a progress from a general to a special form, resulting from the gradual differentiation of the primitively simple morphological units of which the body is composed." The theory of life, known as abiogenisis, or the derivation of living from non-living matter, which has found many advocates, is not sufficiently supported by the results of experiments to justify its acceptance. The experiments have been conducted in accordance with the hypothesis that all living matter is killed by being heated to a certain degree. In solutions, which have been so heated and kept closed from contact with the external air, living organisms have been found; and, therefore, argue the abiogenisists, living matter has been obtained from non-living. Their first proposition, however, is not established as an axiom, as it is yet uncertain what amount of heat, if indeed any, is sufficient to destroy the molecules of protoplasm, which are the rudiments of organization; whether, in fact, intense heat may not be a means of producing new cellular arrangements, and resultingly, new forms. The Darwinian theories of evolution, and origin of species, are branches of the science of biology. (*See* EVOLUTION, ORIGIN OF SPECIES, &c.)

BIPED, *bi'-ped* (Lat., *bis*, twice, and *pes*, *pedis*, a foot), an animal having two feet; as man, bird. It is applied also to a few species of reptiles, some of which are batrachian, some saurian, which may be regarded as forming connecting links between saurians and serpents, and between batrachians and fishes. One of the species of saurians, the *Bipes lepidopodus* of Lacépède, was dissected by Cuvier, who found that though its posterior and only apparent pair of feet had merely the external form of two scaly plates, the integument, in reality, covered a famur or thigh-bone, a tibia and fibula, leg-bones, and four metatarsal or finger-bones. The colour of the Bipes is greenish, with small black blotches scattered over it. It is a native of Australia. Lacépède says of it, "This reptile, like the other species of bipes, ranks between the oviparous quadrupeds and the serpents. It is related to the latter by its general form as well as by the figure, proportion, and distribution of the scales, while it approaches the former by its auditory apertures, and by the hollow tubercles near the anus."

BIPUPILLATE, *bi-pu'-pil-lait* (Lat., *bis*, twice, *pupilla*, a pupil), a term applied to that spot upon the wing of a butterfly resembling an eye, and having two dots or pupils of different tints within it.

BIQUADRATIC POWER, *bi-quod-rat'-ik* (Lat., *bis*, twice, and *quadratus*, squared), in Algebra, the fourth power or squared square of a number or quantity; as 16 is the biquadratic power of 2; for 2×2 is 4, and 4×4 is equal to 16.

Biquadratic Root of a Number is the square root of its square root: thus the biquadratic root of 81 is 3; for the square root of 81 is 9, and the square root of 9 is 3.

Biquadratic Equation, an equation where the unknown quantity of one of the terms has four dimensions. Any biquadratic equation may be generated by the multiplication of four simple equations; or by that of two quadratic equations. (*See* EQUATIONS.)

BIRCH. (*See* BETULA.)

BIRD-CATCHING SPIDER (*Mygale avicularia*), an immense black hairy spider, a native of Cayenne and Surinam. It is nearly two inches in length, and its feet, when stretched out, cover a surface of nearly a foot in diameter. The hooks of its mandibles are conical and very strong. It does not construct a web for the capture of its prey, as do other spiders, but builds in clefts of rocks, or hollows among trees, a funnel-shaped cell of a transparent tissue, resembling fine muslin, and which it itself provides. There it lurks till insects, or even the tiny humming birds, approach, when the spider darts out and secures its victim. There are several bird-catching spiders besides the one in question, and they are found in America, the East Indies, and Africa. As a rule, they make a web like the common European spider, but of such tough threads, that a thrush would scarcely be able to force a passage through. It is even declared, that in certain tropical forests where these spiders abound, their nets will often impede the progress of the traveller. The bite of the larger species of this genus is said to be dangerous to human life.

BIRD-CHERRY. (*See* CERASUS.)

BIRD OF PARADISE, *par'-a-dise* (*Paradisea major*), a name popularly given to the *Paradiseidæ* family of birds, which may be justly regarded as the most beautiful of the feathered tribes. They are found chiefly in New Guinea and the neighbouring islands. Except in the splendour of their plumage, they are closely allied to the crow family, in general form, habits, and voice. Concerning them the most fanciful conjectures have been indulged in, not the least curious being one, that the bird, having no feet, and being unable to walk or swim, was compelled to live entirely on the wing. This error, doubtless, took root in the fact that the legs of the bird being its least ornamental parts, were detached from the skins of the earliest known specimens before they were prepared for exportation. In some localities where they are found, the natives call them *Manuco Denata*, or birds of God, and in other places they are known as birds of the air, birds of the sun, &c. They have great diversity of beauty. Some of them have thinly-barbed feathers to cover the closed wing, so prolonged as to form immense tufts, and extending far backward beyond the body. The Greater Bird of Paradise is rather longer than the common thrush. Its general colour is a deep cinnamon, with the exception of the top of the head and the back of the neck, which is a deep yellow; the feathers which decorate the base of the breast, and cover the whole of the throat, are of a pure emerald green. In the male bird, there springs from each side of the chest a full plume, from sixteen to eighteen inches long, composed of slender shafts, with loose, delicate webs. In some speci mens they are bright yellow at the base, fading gradually into straw-colour. From the tail-coverts spring two slender, naked shafts of great length, which taper gradually to a point, and are of a rich brown. The *Magnificent Bird of Paradise* (*magnifica*) is somewhat smaller than that above described, and is chiefly distinguished by a double sort of ruff, composed of slender plumes that spring from the back of the neck. More of purple and blue enter into the plumage of this bird than the former. The *King Bird of Paradise* (*cincinnurus regius*) is the smallest and the most precious of the family, both on account of its rarity and its splendid colours. It is scarcely as large as a sparrow. The upper parts of its body are of the richest chestnut-brown, and the under parts dazzling white. A zone of golden green extends across the chest; from the sides spring two fan-like plumes, consisting of six or seven dusky feathers of the richest golden green. From the tail-coverts spring two long, slender shafts, each elegantly terminating in a broad emerald web, rising from one side only of the shaft, and disposed into a flat spiral curl. The breast and legs are yellowish-brown. These birds fly in flocks of about thirty or forty, led, it is said, by a single bird. They fly against the wind, lest their plumage should be discomposed. When flying, they make a noise like starlings; but their common cry is little more melodious than that of the raven. They are captured by bird-lime and blunted arrows. In their wild state, they feed on the fruit of the teak tree, figs, and butterflies. In confinement, they are fed on rice and insects. They are unfitted for any other than a tropical climate, and only a very few specimens have been preserved alive in this country. The young male birds at first resemble the females, which are of a dusky brown, and possesses neither plumes nor lengthened tail feathers; but after the fourth moulting, the gorgeous plumage appears. At the breeding season, the males assemble in groups of twelve or fourteen, on the branches of trees, and "dance" so as to display their magnificent plumage to attract the females.

BIRD'S FOOT, *ornithopus*, a genus of plants of the natural order *Leguminosæ*, sub-order *Papilionaceæ*. The botanical and the popular names are alike derived from the resemblance of the curved pods to birds' claws. The British species (*O. perpusillus*) is a small plant with white and red flowers. A much larger species (*O. sativus*) named Serradilla, is cultivated in Portugal as food for cattle.

Bird's-foot Trefoil (*Lotus corniculatus*), a plant very abundant in pasture lands in this country, resembling in some respects the trefoils or clovers, but with clusters of pods resembling a bird's foot. It is a favourite food for cattle. There is a larger species (*Lotus major*) with more compact heads of smaller flowers and much smaller seeds, also a native of Great Britain, and generally found in moist places where there is much underwood. In some of the southern parts of Europe, a species known as the winged pea (*Lotus tetragonobulus*) has four membranous wings connected with the pods. The seeds are used occasionally as substitutes for coffee. The name Lotus has been given to this genus of plants because one of the species is supposed to have been one of the plants so named by the Greeks. (*See* LOTUS.)

BIRD'S-EYE LIMESTONE, a division of the Trenton group of the Lower Silurians of North America, containing many fossils.

BIRDS (Ang.-Sax.), feathered, vertebrated, and oviparous bipeds, which are generally so constructed as to be able to support themselves in the air, and make progress through it. *Aves*, or birds, are the second class of vertebrated animals, and the first of oviparous animals, including all those which have warm blood. About 5,000 different birds are known. Elegant and symmetrical as the outward form of the bird is, it is surpassed by the internal construction, which is peculiarly adapted to its habits and mode of living. The large head, broad shoulders, deep chest, and sinewy limbs of the quadruped, are replaced in birds by the pointed beak, the long supple neck, the gently-swelling shoulder, the expansive wings, the tapering tail, and the light, bony feet, all of which assist them in their motion through the atmosphere. Their bodies are protected from the intense cold in the air by a soft and delicate plumage, and their wings, although made of the lightest materials, are so powerful as to be able to strike the air with great force; their tails also serve as rudders, steering them in any direction they please. Internally, the frame of a bird is quite as wonderfully and appropriately constructed. All the bones are thin and delicately formed, except the sternum, or breast-bone, which is very large and strong. The clavicles, or collar-bones, are generally joined, forming the bone called the merrythought, which, together with two bones called the coracoid bones, keep the shoulders apart, and serve to resist the compressing action of the wings. All the muscles, except the pectoral muscle, are small and light. In men and in quadrupeds, the pectoral muscles are small when compared with those of birds, which are very strong, and are situated on either side of the breast-bones. These muscles are used for moving the wings. The anterior extremities of birds are always wings, and never arms or legs. In the cases of birds whose wings are too small to enable them to fly, they are used either as paddles in the water or to assist them in running. The great auk is an instance of the former, and the ostrich of the latter. The lungs of a bird are situate close to the backbone and ribs. The air, entering them from the windpipe, passes through, and is conveyed to a number of membranous cells which lie upon the sides of the pericardium, and communicate with those of the sternum. These cells are in some birds continued down the wings, and even to the pinions and thighs and other parts of the body. They can be filled with air at pleasure, and by this means the bird can render his body heavy or light, when necessary, either in flying, swimming, or running. The vertebral column in birds is usually rigid in the central parts and flexible at both extremities. By this means the ribs are strengthened, and the free motion of the neck and tail assisted. In birds which do not fly, the vertebræ retain some amount of motion throughout the back; but, in general, they become ankylosed, or firmly united and cemented together by bone. The skull differs from that of the mammalia; the cranial bones are consolidated, and there are no sutures in the skull of a bird. It is articulated to that part of the vertebral column called the neck by one condyle or joint, which is situated at the front margin of the great occipital opening, through which the brain descends into the vertebral column, being prolonged as it were into the spinal cord. It is by this peculiar formation that birds have so free a motion of the head and neck, especially in a horizontal direction. The wryneck is a special instance of this faculty. Birds generally sleep with the head turned back and nestled under the wing. In mental capacity, birds fully equal quadrupeds, and in some respects, indeed, surpass them. In some of the songsters, the brain has been said to exceed that of man, when considered with reference to the comparative size of the head and body. The size of the brain of an eagle in relation to its body has been reckoned to be $\frac{1}{260}$th part, that of a canary-bird $\frac{1}{14}$th, and that of a man $\frac{1}{22}$nd to $\frac{1}{33}$rd part. Parrots and starlings retain many words and phrases fixed in their memories, and some singing-birds remember whole melodies. Birds of passage, after travelling thousands of miles, and after being absent for a great length of time, remember the exact spot where their nests were previously located, or where they were reared. Prudence, cunning, and docility, are practically exemplified in the different positions in which birds build their nests, some in the neighbourhood of human beings and some in uninhabited places. Sight, smell, and hearing, are the most acute senses in birds. There are two classes of birds—the carnivorous and the granivorous; and there is a middle kind, as in quadrupeds, which partakes of the nature of both. The carnivorous class is provided with long wings, furnished with very powerful muscles, in order to be able to fly great distances. They have strong hooked beaks, and sharp formidable claws; they have large heads, short necks, and strong, sinewy limbs; their sight is wonderfully acute, so as to enable them to see their prey at a great height in the air; and they swoop down upon their victims with an unerring aim. Carnivorous birds are solitary and sullen, and seldom live together in flocks. Granivorous birds, whose food consists of grain of various sorts, have larger intestines than carnivorous birds, and their digestive organs are more complicated. The form of the bill varies, according to the kind of food which the bird subsists on. (*See* BILL.) The food is passed from the bill into the stomach, which consists of three parts—

the crop, which lies in front of the breast-bone, the membranous stomach, and the gizzard. In the crop, the food undergoes a partial dilution from a fluid furnished by the glands. In the membranous stomach it is still further diluted, and then passes into the gizzard, which acts as a powerful mill, and in which the food is ground down and triturated. The action of the gizzard is strengthened by small hard stones, which many birds swallow with their food. The digestive powers of the gizzard are very extraordinary. An experiment was tried upon a turkey-cock, when a ball of lead, studded with twelve small lancets, was forced down his throat. After eight hours had passed, the gizzard was opened, and the ball was found by itself, the whole of the lancets being broken to pieces. In the London museum of the College of Surgeons there is a large bottle entirely filled with pebbles, &c., taken from the stomach of an ostrich. In some experiments tried upon a hen, it was found that a louis d'or, after being swallowed for four days, lost sixteen grains; and the weight of an onyx was diminished one-fourth. In carnivorous birds the muscles connected with the gizzard are very weak. The liver of domestic birds is much larger than that of wild birds. The eyes of birds are admirably adapted for sight. The impression of external objects is rendered more vivid and distinct by a particular modification of the optic nerve. They have three eyelids, two of which, the upper and lower, are closed in most species by the elevation of the lower one. This may be noticed in domestic fowls. A small number of birds, such as the owl and goat-sucker, can depress the upper eyelid. The third eyelid, a thin semi-transparent membrane, lies, when at rest, in the inner corner of the eye, with its loose edge nearly vertical. It can be drawn over the eye like a curtain; and by its means the eagle is said to be able to look at the sun. Were the eyes of birds less perfectly formed, on account of the rapidity of their flight, they would be liable to fly against any object in their way. The voices of birds distinguish them from all the rest of the animal world. The organs of the voice closely resemble certain musical instruments. At the bifurcation of the windpipe is a glottis furnished with appropriate muscles, where the voice is formed. The gift of song is only possessed by male birds, and their notes are generally expressive of love. They are silent when in ill health, in sadness, or during rough weather; but when they are cheerful they always sing. They express different feelings with varied modulation; and the fear of approaching danger, hunger, love, longing for their mates, &c., are all expressed by changes in the tone of the song. This faculty is possessed by no other animal. Every form which the most lively fancy could create, and every hue that the imagination could conceive, are to be found in the feathers of birds. Two changes occur in the feathers—one in the spring and another in the autumn. In the former case, the changes occur just before the breeding-time, and the bird gains a number of new feathers without losing the old ones. In the latter, or moulting season, the old feathers fall off and new ones appear. The feathers of the wings are larger and stronger than those on other parts of the body. They are called wing-feathers, quill-feathers, or quills. At the base of each quill are small feathers called wing-coverts. The tail-feathers are also provided with coverts above and below. Many birds have very ornamental plumage in their tails; and the feathers often take other remarkable forms in different parts of the body; such as shoulder-tufts, ruffs, crests, &c. When spring approaches, wild birds begin to pair and to make arrangements for their young. The notes of the male bird at this time are very loud. The marriage contract then entered into is for the season faithfully adhered to; and in case one of the pair dies, its mate does not survive it long. The reproduction of the species among birds is carried on by means of eggs, which pass from the body of the female and are afterwards hatched. The warmth necessary for incubation is usually derived from the body of the bird, which sits upon the eggs. This duty is generally performed by the female bird; but in some cases it is undertaken by the male. (*See* EGG, HATCHING, REPRODUCTION.) Many sea-fowl make no nests, but deposit their eggs on the bare rock, or in rough holes scratched out of the earth or sand. The ostrich allows her eggs to be hatched by the heat of the sun in warm climates; but she sits and broods over them where the temperature is colder. Birds generally brood once in the year, but some brood twice; and the number of eggs they lay varies from one to twenty. The cuckoo and a small number of other birds lay their eggs in the nests of other birds, in order to be hatched by them; and several birds are able to run about and find food as soon as they leave the nest, while others remain in the nest for days and weeks before they can venture out. During this period the parent birds find food for them. At the breeding-season, birds are often gregarious, and sometimes live together in one large nest. Birds' nests are constructed with such delicate and exquisite art and ingenuity, as to call forth the admiration of every observer. Birds of the same species, wherever they may be found, build their nests with the same kind of materials and in the same manner. The situations they select, the materials they use, and the form in which they build, are wonderfully adapted to the particular nature and necessities of the bird. They are generally lined with moss, wool, fine hair, or down, and have an exterior composed of straws, twigs or roots, and dry grass, mixed with clay. Birds that build early in the spring, such as the blackbird and thrush, line their nests with loam, in order to keep out the cold air. The common sparrow, which builds four or five nests in the year, is not particular as to the situation he chooses. Sometimes he locates himself in ivy, sometimes in trees and hedges, and often under the eaves of houses. Some birds carefully conceal their nests, and some leave them open and apparent; some, like the jay, build them so loosely that the eggs can be seen through the twigs; and some very compactly, such as the golden-crested wren, which constructs its nest with small pieces of moss and spiders' web interweaved. It is nearly an inch in thickness, and is lined with a profusion of soft downy feathers. While hatching, all birds, as a general rule, resort to those places where their particular food is plentiful, and where there is an abundance of the proper material with which to construct their nests. Some water-fouls pluck the down from their own breasts, in order to line their dwellings; but they usually build in out-of-the way places, since their food is not that which is gathered by ordinary birds. While hatching, the female bird is remarkably patient. She is usually plump when she begins to sit; but before the eggs are hatched she is almost reduced to a skeleton. Neither hunger nor danger will make her leave her post of duty; but if, after being absent, the male and female birds perceive that their nest has been meddled with, they will often leave, and build in a more secure place. After the young are fledged and flown, the nest is generally deserted. Many small birds live upon worms, caterpillars, &c.; and it has been remarked, "that a single pair of sparrows, during the time they are feeding their young, will destroy about four thousand caterpillars weekly: they likewise feed their young with butterflies and other winged insects, each of which, if not destroyed in this manner, would be productive of many thousands of caterpillars." It is only of late years that the value of small birds as destroyers of vermin has been recognised; previously, farmers destroyed birds, supposing that they spoiled the crops. That they do commit ravages is beyond question, but the advantage they confer by destroying other ravagers more than counterbalances. Whilst moulting or changing their feathers, many birds turn sickly, and often die. Every country and climate have birds which are peculiar to them; but many migrate to distant lands when the season becomes too severe for them. Near the equator, the birds are remarkable for their brilliant and varied plumage; but their voices are usually harsh and discordant. In the frigid zone, where fish is plentiful, they are mostly aquatic, and their plumage consists of soft, warm, downy feathers. In all countries birds live longer, comparatively, than either men or quadrupeds in the same place. Many kinds of birds are important in an economical sense. A large profit is derived from the rearing of domestic fowls; and the flesh and eggs of some birds can be eaten, common birds, however, being generally an exception. Feathers are employed in many useful and ornamental ways, and the dung of birds is useful for manure. (*See* GUANO.) For mention of the labours of naturalists and writers in relation to birds, *see* ORNITHOLOGY.

Classification of Birds.—The following classification of birds by Professor Owen is that now generally accepted by naturalists:—*Raptores* (birds of prey)—eagle, hawk, vulture, owl, &c.; *Scansores* (climbers)—woodpecker, cuckoo, parrot, &c.; *Passeres* (from the Latin *passer*, a sparrow)—sparrow, thrush, swallow, blackbird, lark, &c.; *Columbidæ* (*columba*, a pigeon)—pigeon, dove; *Gallinæa* (*gallus*, a cock)—domestic fowl, grouse, partridge, turkey, peacock, &c.; *Cursoria*, (runners)—ostrich, emu, buzzard, apteryx, &c.; *Grallatores* (waders)—crane, heron, stork, snipe, plover, sandpiper, &c.; *Palmipedes* (web-footed)—duck, gull, albatross, pelican, &c. (*See* various headings.)

Birds of Passage are those birds which migrate from one country to another at certain times, depending on the seasons. Availing themselves of their power of flying, many birds remove themselves, at certain periods of the year, to places where the temperature is more congenial and the supply of food more abundant. Even in the tropics, some birds, like the bird of paradise, migrate from island to island, according to the change of seasons from the dry to the wet monsoon. In the temperate and colder regions, however, birds of passage usually migrate from south to north or from north to south, as winter passes into summer or summer into winter. They are usually divided into two classes—winter and summer birds of passage, the term being applied according to the time when they make their appearance. Hence, the summer birds of passage in one country are the winter birds of passage in another. The approach of spring is always heralded by the arrival of summer birds of passage, and their appearance is always connected with pleasant and cheerful associations. During the winter season, large numbers of winter birds of passage, such as wild swans, geese, and other water-fowls, leave the frozen waters of the north and migrate to the shores of Great Britain. Woodcocks, fieldfares, redwings, and many other birds which breed in northern countries, also make their appearance regularly. The migrations of the pigeons in America are very extraordinary, on account of the vast numbers which compose the flocks. The return of some birds of passage can be depended on almost to a single day; and in some places, such as St. Kilda, where the inhabitants depend for their existence on the sea-fowl, their return is almost punctually on the same date every year. It has been observed that some birds of passage leave at the regular time, while others seem dependent on the weather and temperature. Nearly all birds of this species have long and powerful wings; but some are short-winged. They can pass over great distances in a very short period of time; and as they can fly with ease at the rate of 50 to 150 miles an hour, they often arrive at their destination with comparative ease; but some birds, such as the woodcock, are often found much exhausted after their flight. That birds of passage return to the same places which they formerly inhabited, has been clearly proved in the case of swallows.

Birds of Prey, a term usually employed to distinguish the order of birds called *Raptores*. They have remarkably keen sight, and great perfection in the sense of smell. Many birds, however, which follow and prey upon other birds, do not belong to this order; and those which live upon fishes, worms, and insects, are not reckoned as birds of prey. There are two sections into which birds of prey are divided—the diurnal and the nocturnal: the latter division is composed entirely of fowls.

BIRTHWORTS. (*See* ARISTOLOCHIA.)

BISH. (*See* ACONITUM.)

BISON, *bi'-son* (Lat., *Bos Bonassus*).—The principal European regions where this animal is found are the marshy forests of Poland, the Carpathian mountians, and Lithuania. (*See* AUROCH.) The American bison (*Bos Americanus*, or *B. bison*), commonly called the American buffalo, is larger, shaggier, and fiercer even than the European species. It possesses immense strength, and can sometimes hold its own even against the grisly bear. Weaker foes it tramples beneath its feet. The hair about its neck and shoulders is bushier, and of a fine texture. The hump, which is oblong, diminishes in height towards the tail, lending a considerable obliquity to the outline of the back. On the crown of the head the hair rises in an immense mass, and shows in thick, close curls before the horns; below the chin the hair grows like a beard, and falls as low as the knees. Its flesh affords food for the roaming Indian tribes, the hump being considered a great delicacy; its skin serves them for coats, and beds, and boots; and walls for their tents, and tiles for the roof; and for saddles, and bridles, and lassos. The bones are converted into saddle-trees, into war-clubs, into whistles, and into musical instruments. Of the horns are made pins, needles, ladles, spoons, and spear-heads; the sinews serve as strings to their bows, thread to stitch their buffalo-robes and to form their tent-cloths, and for the attachment to their persons of scalps and such pleasing nic-nacs as they may set store by. The bison's feet and hoofs, when stewed down, yield a superior glue, largely used in the construction of hunting-spears and arrows. The tallow is an important article of trade, and one animal will sometimes yield as much as 150 lbs. The mane of the animal is twisted into ropes and horse-halters, and the tuft at the extremity of its tail is used as a fly-brush. The brains even are not wasted, but used in the preparation of leather from the bison's hide. The number of bisons roaming the vast North American prairies is rapidly diminishing, so eagerly has it been hunted by white men and redskins. During the pairing season, the roaring of the bulls is terrific, and the combats that take place between them are unequalled even among the carnivora. They swim broad rivers in nearly the same order as they traverse plains—viz., in a dense animated mass, pressing so close at each others' heels that the foremost dare not stop from peril of being trodden to death. The Indians profit by this peculiarity, and, creeping up to a herd, drive them forward, with hideous shouts and yells, to the verge of a precipice, over which a score or so will certainly topple.

BISTORT. (*See* POLYGONUM.)

BITTERN, *bit'-tern* (Du., *butoor*) (*Botaurus stellaris*). A genus of wading birds, comprising several species closely allied to the heron, from which, however, they are distinguished by the long, loose plumage of the neck, which can be erected at pleasure, and the greater length of the toes. The common bittern (*Botaurus stellaris*) is generally found throughout the entire Eastern hemisphere. In summer it chiefly affects the north of Europe and Siberia, at other seasons the mild regions skirting the Mediterranean, in China, India, and even in Southern Africa. It was formerly plentiful in this country; but the universal drainage of marsh land has driven it to seek a locality more congenial to its nature. When alarmed, the bittern emits a peculiar cry, by no means pleasant to hear; but on the approach of the breeding season the sounds it utters are of the most hollow and melancholy kind. The provincial English names are "Mere-drum," "Night-raven," and "Bull of the Frog." The length of the common bittern is about thirty inches, and its voracity remarkable. Mr. Yarrell found in the stomach of one the bones of a good-sized pike. The little bittern (*B. minutus*) is also a summer visitor to these islands, and is the smallest variety of the family to which it belongs known in Great Britain. It is an inhabitant of a wide range of countries, as it has been met with in south-western Asia, in Holland, Germany, southern France, and Italy, and even as far north as Sweden. The American bittern (*B. lentiginosus*) is somewhat smaller than the common bittern. On the other side of the Atlantic this bird has different names in the different states which it inhabits, being called, among other titles, Indian-billet, Indian-hen, and Dunkadoo. The Australian bittern (*B. Australis*) very closely resembles the bittern of Europe. The bittern once afforded great sport to falconers in England, and it was protected by severe penalties. Any one who destroyed or took away the eggs of a bittern was liable to a year's imprisonment and a fine of eightpence for each egg, by a statute of Henry VIII. Yarrell, in his *History of British Birds*, informs us that "the bittern was formerly in some estimation as an article of food for the table. The flesh is said to resemble that of the leveret in colour and taste, with some of the flavour of wild fowl." Sir Thomas Browne says that young bitterns were considered a better dish than young herons. Turning to Yarrell once more, we find that "the bittern constantly feeding at night, is, therefore, seldom seen on wing in the day, but remains with head erect in thick beds of reeds, or conceals itself among flags, rushes, or other rank aquatic vegetation which afford it a solitary and secure retreat:" from such situations it is with difficulty made to take flight; and when at length obliged to get on wing, the pace is dull and flagging, and seldom sustained to any great distance. M. Viellot says that in France it is occasionally found in woods. Neither females nor the young differ much in their plumage from the male bird.

BITTERSWEET. (*See* SOLANUM.)

BITTERWOOD. (*See* XYLOPIA.)

BITUMEN, *bit'-u-men* (from Gr., *pitus*, the pitch-tree, because it resembles pitch), is a term which includes many fossil bodies of a resinous nature. True bitumen is fossil tar, and is the product of the action of an elevated heat upon vegetable bodies. The surrounding stratum, which is generally tertiary, is mostly impregnated with bitumen, giving rise to bituminous clay, shale, or coal, according to its nature. In many cases, bitumen occurs in nature as a regular deposit, forming beds like true coal. Lignites (which *see*) contain bitumen imbebbed in them in small quantities. Asphalt is a finer sort of bitumen, much used in the preparation of paving-material. Bitumen is closely allied in its properties to coal-tar, which is produced by the destructive distillation of coal. The first process for obtaining pictures by means of light was founded upon the fact that the bitumen of Judea when exposed to the sun's rays became insoluble in oil of lavender, whilst those parts remaining in shadow preserve their solubility. Elastic bitumen, or mineral Caoutchouc is an interesting variety of the mineral. (*See* ELATERITE.)

BIVALVE, *bi'-valv* (Lat., *bis*, double, *valvæ*, valves), in Conchology, a term given to those kinds of shell-fish which possess two shells, in contradistinction to those which possess but one, and which are termed univalve. (*See* MOLLUSCA.) As familiar examples of bivalves may be mentioned the mussel, cockle, and oyster. Bivalve shells form the testaceous envelope of mollusks, and are composed of two concave plates connected by a hinge, having an elastic ligament.

BIXACEÆ, OR FLACOURTIACEÆ, *bix-ai'-se-e*, a natural order of dicotyledonous plants in the sub-class *Thalamifloræ*. They are shrubs or small trees, with alternate leaves, usually entire and leathery, and very often dotted. The flowers are polypetalous or apetalous, the stamens being hypogynous, and equal in number to the petals, or some multiple of them. The fruit is one-celled, dehiscent or indehiscent, having a thin pulp in its centre. The seeds are numerous, usually enveloped in a covering formed by the withered pulp. The plants of this order are almost confined to the hottest parts of the East and West Indies and Africa. There are 34 genera and about 90 species. Many are feebly bitter and astringent, and have been used as stomachics. The bark of *Aphloia* is said to be emetic. The fruits of *Oncoba* and of some species of *Flacourtia* are edible and wholesome. The most important plant of the order is *Bixa orellana*, which yields a red dye. (*See* ANNATTO.) The reddish pulp covering the seeds is the source of this colouring matter.

BIXIN, *bix'-in* (from *bixa*, the name of the tree whence annatto is derived), an orange-red colouring matter, found in annatto, to which it owes its dyeing properties. It is a resinous substance, soluble in alcohol and ether, but sparingly so in water. The alkalies dissolve it, producing a deep red colour, but, on neutralizing, it falls as an orange precipitate. It is also soluble in fixed oils.

BLACK ALDER. (*See* RHAMNUS.)

BLACK ANT. (*See* ANT.)

BLACK BAND, a clayey carbonate of iron containing sufficient carbonaceous matter to allow of its being calcined without any additional fuel. It is found principally in the Scotch coal-fields, and is the most important ore of iron in those districts. (*See* IRON.)

BLACK-BEETLE, *be'-tel* (*Blatta orientalis*). This insect, though now common throughout Europe, is supposed to have been originally a native of India, and, by the progress of commerce, carried thence westward. On board merchant ships, the black-beetle is very commonly found; and it is said to be more plentiful in seaport towns than other places. All sorts of matter, vegetable or animal, suits the appetite of this insect. The curious way in which insects of this genus lay their eggs is worth mention. Instead of emerging singly from the abdomen of the female, they are inclosed in a horny case almost half as large as the abdomen of the parent. Within this the eggs are ranged in two rows, separated by a partition which runs down the middle of the case; each egg is also separated from the next by a similar partition. This egg-case is attached to the wall or floor with a strong adhesive liquid furnished by the mother. When the larvæ are hatched, they emit from their mouths a fluid which dissolves the walls of their prison, and they are set free.

BLACKBERRY. (*See* RUBUS.)

BLACKBIRD, *blak'-bird* (*Merula vulgaris*). —This familiar bird furnishes a fair example of the general size and appearance of the typical thrushes. Like the corvine or crow family—of which, indeed, the thrushes are but representatives—these birds make their way upon the ground, in the air, and among trees, with equal facility; and this perfection of foot is more or less prevalent throughout the family. It builds a large cup-shaped nest, composed of grass, roots, and stems externally, coated inside with mud, and lined with soft grasses. It lays four or five eggs, generally of a light blue. There is sometimes, however, so little difference between the eggs of the blackbird and the common thrush, as to make it impossible for any one but an accomplished ornithologist to distinguish between them. The blackbird has a powerful voice and great power of song and imitation, and it is asserted, has been trained to utter words.

BLACKCAP, (*Curruca atricapilla*), one of the *Sylviadæ*, or Warblers, and allied to the nightingale, by which bird only is it surpassed as a sweet singer; indeed, some persons prefer its shake or trilling note. The back, wings, and tail are of an ash-brown colour; the chin, throat, and breast grey; the belly white. The upper part of the head in the male is jet black. The feathers of the head, both in the male and female, are somewhat erected, giving the bird a hooded appearance, whence the popular name, "the monk," given in Germany. It is a bird of passage, arriving in Britain (mostly in the southern counties) early in spring, and leaving in September. As a cage bird it is greatly admired, not only on account of its beautiful song, but for its intelligence and affectionate nature.

BLACKCAP TITMOUSE. (*See* TITMOUSE.)

BLACK CHALK, a variety of clay-slate, containing a large amount of carbon, found on a rock of a slatey texture and bluish-black colour, chiefly in the island of Islay, Carnarvonshire, and Spain. It is used for draining, and, when ground down, for a black pigment.

BLACKCOCK, *blak'-kok* (*Tetrao tetrix*), a species of the grouse family, rarely seen in England, but abundant in Scotland, and found also in various parts of Europe, especially in Sweden and Lapland. The male (much larger than the female) sometimes weighs four pounds, and is of a bright bluish-black colour with a white bar on the wings, and a mixture of black and white on the legs; over the eye is a piece of scarlet skin. The outer feathers on each side of the tail have a peculiar curve outwards. It is frequently known as the heath-fowl, or black grouse. In its habits the blackcock closely resembles the capercalzie, inhabiting the low-lying districts, and feeding chiefly on the young shoots of shrubs, and seeds, and berries. According to Yarrell, in the winter time the bird's crop is frequently found filled with the young shoots of fir.

BLACKFISH (*Centrolophus Moris*), a fish of the dolphin kind, found in the Mediterranean and on the western coasts of Europe. It is nearly thirty inches long; it has a dorsal fin rising from a thin elevated ridge. It is remarkable for strength and velocity of movement. The flesh is said to be of delicious flavour.

BLACK-JACK, a name given by miners to sulphide of zinc, or zinc-blende. (*See* ZINC.)

BLACK-JACK TREE. (*See* OAK.)

BLACK-LEAD. The common commercial name for graphite, or plumbago, given to that substance from its metallic leaden-grey lustre. It is, however, nearly pure carbon, and contains no lead. (*See* GRAPHITE, PLUMBAGO, CARBON.)

BLACK QUARTER, an apoplectic disease peculiar to cattle, otherwise known as Black Leg, Quarter Evil, and by various other names. It is not contagious, but limited to districts, but attended in hot weather by the development of a fatal blood-poison. (*See* MALIGNANT PUSTULE.) The chief causes are rich pasture on undrained or retentive soils, and sudden changes from poor to rich feeding. Death generally follows the first appearance of the disease in a few hours.

BLACK SNAKE. (*See* COLUBER.)

BLACKTHORN. (*See* PRUNUS.)

BLACK WAD.—A dense black earthy mineral used as a pigment, also in glazing pottery, and in the manufacture of glass and chlorine. It is a hydrated peroxide of manganese mixed with various impurities.

BLADDER, *blad'-der* (Sax., *blader*, from *blawan*, to blow), is a thin membraneous bag, which serves as a receptacle for the urine secreted by the kidneys, until it is voided through the urethra. It is situated in the pelvis, and is kept in its place by ligaments, which are usually divided into true and false, the latter being formed of folds of the peritoneum. It is composed of three coats or membranes—the external or fibrous membrane, the middle or muscular membrane, and the internal or mucous membrane. Its figure is nearly that of a short oval. It is broader on the fore and back than on the lateral parts; rounder about than below, when empty; and broader below than above, when full. It is divided by anatomists into the fundus or upper portion, the body, and the neck —that portion which is constricted by a sphincter muscle, and communicates with the urethra. On each side, rather below its middle, it receives the two ducts called ureters, which convey the urine from the kidneys into the bladder. The bladder, like every other organ of the body, is liable to certain diseases, one of the most common of which is inflammation, or cystitis. It chiefly affects the mucous coat of the bladder; but all the other coats may be implicated; and it is either chronic or acute. The acute form is known by great pain in the region of the bladder, attended with fever and hard pulse, and a frequent and painful discharge of urine, or a retention. The disease runs its course with rapidity, and subsides, or carries off the patient, in a few days. It is to be treated by local bleeding and hot fomentations, together with opiates. The chronic form of this disease is best treated by tonics and sedatives. The causes of this disease are various. It often arises from calcarious secretions, which in that case must be removed. Irritability may exist in the bladder, unaccompanied by inflammation, and may arise from over-distension or from nervousness. It is to be treated by the administration of tonics. The bladder may be affected with paralysis, resulting either from accident, from disease of the nervous centres, or from over distention. It gives rise to incontinence of urine, which, however, is to be distinguished from that which sometimes arises from irritability, inasmuch as in this case the bladder is full, and has no power to evacuate properly; so that it must be drawn off by the catheter. Retention of urine may be caused by mechanical obstacles to its exit, by paralysis, or by a want of power over the muscles.

BLADDERLOCKS. (*See* ALARIA.)

BLADDER-NUT (*Staphylea pinnata*), a genus of plants classified by some botanists as a small natural order, but by others united with *Celastraceæ*. About fourteen species are known, found in very different climates, and scattered over the world. They are mostly small trees of elegant appearance. The common Bladder-nut (which derives its name from the curiously inflated capsule and the hard seed) is an ornamental tree, a native of Eastern Europe and the temperate regions of Asia. The seeds have a slightly aperient quality, and the flowers are pickled as copeia.

BLADDER SENNA. (*See* COLUTEA.)

BLADDERWORT, a genus of plants (*Utricularia*) of the natural order *Lentibulariaceæ*. They grow in lakes and marshes in almost all parts of the world, especially in the tropics. The roots, stems, and leaves are furnished with little bladder-like vessels, which are filled with water till it is necessary that the plant should rise for the expansion of the flowers, when they become filled with air; and they again give place to water, after flowering is over, so that the seeds ripen at the bottom of the water. Only three species, all having yellow flowers, are known in Britain.

BLADE, a term generally applied to the expanded portion of a leaf. It is the part which is usually the most highly developed, and which is popularly known as the leaf. The terms *lamina* and *limb* are also applied to this part. (*See* LEAF.)

BLAPS, *blaps*, the typical genus of the family *Blapsidæ*, of that order of insects named *Coleoptera*. The blaps is the only insect of the family *Blapsidæ* to be met with in this country. Its scientific name is *Blaps mortisaga*, its common one the Churchyard Beetle. It is about an inch long, sometimes of a dark, but more frequently of a black colour, and is generally to be found in murky, damp situations, or the dirty parts of dwelling-houses. *Blaps sulcata*, cooked with butter, is eaten by Turkish women in Egypt in order to attain that corpulent condition of body so highly esteemed as an element of female beauty in the east.

BLATTA. (*See* BLATTIDÆ.)

BLATTIDÆ, *blat'-ti-de* (Lat., *blatta*, an insect that eats away clothes), a family of insects belonging to the order *Orthoptera*. The insects of this family are extremely active and voracious. According to Mr. Stephens, there are only seven species indigenous to this country, among the most disagreeable of which is the well-known Cock-roach, or Black-beetle. (*See* BLACK-BEETLE.) In hot climates, where the number of species of this family is very large, their ravages are exceedingly great. The largest of the genus is the *Blatta gigantea*, which is indigenous to the warmer parts of Asia, South America, and Africa, where they plunder and erode all kinds of victuals, dressed and undressed, and damage all sorts of clothes, especially such as are touched with powder, pomatum, and similar substances; everything made of leather, books, paper, and various other articles. In old timber and deal houses, when the family is retired at night to sleep, this insect, among other disagreeable properties, has the power of making a noise which very much resembles a pretty smart knocking with the knuckle upon the wainscoting. The *Blatta gigantea*, in the West Indies, is therefore frequently known by the name of the Drummer. The *Blatta Americana*, or American cockroach, is another member of this troublesome family. Its size is somewhat larger than that of the black beetle; but its destructive powers are little less. It is now becoming common in England, especially in seaport-towns, where it is brought with merchandise from abroad. The *Blatta lapponica* is a smaller species, which is to be found in Lapland in great numbers. When very numerous, instances have been known where they have devoured the whole of the natives' winter provision of dried fish. Perhaps the most singular circumstance connected with these insects consists in the manner in which they deposit their eggs. Instead of laying her eggs singly, as most insects do, the female drops an oblong mass, which serves as a case for an entire family of young Blattæ. From this prison Nature has provided the young insects with a means of escape at the fitting moment. This consists of a fluid which they emit, and which softens the cement of the denticulated margins of the case, or cocoon, as it might be termed, in which they have hither to been enclosed. The cocoon of the blattæ contains about sixteen eggs, of an oblong oval form, arranged in a double series. In this protecting case the young insects are brought to a considerable state of maturity ere they emerge into freedom.

BLEAK, *bleek* (*Leuciscus alburnus*), a little silvery-scaled fish, well known to British anglers. It belongs to the family of *Cypeinidæ*, and is of the same genus as the roach, dace, and minnow. It is six or seven inches long, and is more elongated than the dace, and the dorsal fin is farther back. The back is of an olive-green colour; the sides, belly, and gill-covers, silvery white. If well cooked, they afford delicate eating. It is said that the scales of the bleak are used in the manufacture of imitation pearls.

BLENDE, *blend* (Ger., *blenden*, to dazzle), a term applied to several minerals possessed of a peculiar glittering lustre, such as *hornblende*, *bismuth-blende*, &c. When used alone it generally designates zinc-blende, or *garnet blende*, or *sulphuret of zinc*. (*See* BLACK JACK.)

Antimony Blende, a rare mineral with a shining surface, known also as Red Antimony, and composed of sulphur and antimony.

Manganese Blende, similar to the above, but composed of manganese and sulphur.

Ruby Blende sometimes used indiscriminately to designate any glistening mineral of a ruby colour, but applied particularly to Pyrargyrite on the ores of silver.

BLENHEIM SPANIEL. (*See* SPANIEL.)

BLENNIUS, OR BLENNY, *blen'-ni-us* (Gr., *blenna*, mucus), a genus of fishes belonging to the section *Acanthopterygii* and the family *Goboidæ*, principally recognizable from their having the ventral fin placed before the pectoral. Their skins are frequently destitute of scales but are covered with an abundance of slimy matter. Their eyes are shaded by a fringed appendage; their bodies elongated. They congregate in small shoals upon rocky coasts, where, upon the reflux of the tide, they may be often found in pools among the crevices of the rocks. Five species frequent the English coast—Montagu's, or the Diminutive Blenny; the Ocellated Blenny, or Butterfly-fish; the Gattoruginous Blenny; the Shanny; and the Crested, or Yarrell's Blenny.

BLENNORRHŒA, *blen-nor-re'-a* (Gr., *blenna*, mucus; *rheo*, I flow), a term used to denote an unusual discharge of mucus from any of the mucous membranes. (*See also* MUCOUS.)

BLENNY. (*See* BLENNIUS.)

BLESBOK, *bles'-bok* (*Gazella albifrons*), a fleet antelope of Southern Africa. (*See* ANTELOPE.)

BLETS.—Spots of rottenness in fruit. Hence the term *bletting*.

BLIGHT, *blite* (Sax., *belihtan*, to fall upon), a general term for a certain class of diseases which affect the cultivated grasses, especially the cerealia. It is generally limited to the disease to which wheat and other grains are liable, when the outside of the plant remains green and flourishing while the interior is filled with a powder having a very fœtid smell. This powder consists of a microscopical fungus in the shape of balls, so minute that four millions of them may be present in a grain. This disease is also called smut-balls, bunt, pepper-brand, and stinking rust. The name of blight has been applied to every kind of disease incidental to plants through changes in the state of the atmosphere, the condition of the soil, ravages of insects, parasitic fungi, &c. The name has also been given to diseases of plants which have arisen through errors in cultivation. Insects and parasitic fungi attack unhealthy plants first; and often when the evil has been ascribed to them, the true cause has been some mistake in manuring the soil. There is a kind of blight sometimes very prevalent, which has been referred to fungi, but which is, in fact, nothing more than an excessive development of the epidermal cells, which are no longer kept within bounds by the real cuticle, but become elongated, and frequently branched in various ways, so as to form spongy or mealy patches, which are sometimes in such abundance as from their bright colour or peculiar aspect to attract general notice. This species of blight does little damage to the plant on which it is found, and is most commonly observed on woody plants, such as vines and hawthorn. A similar effect sometimes appears on a few herbaceous plants.

BLIND COAL, a common name for those varieties of coal containing little or no bituminous matter, which are said to burn blindly, because they give out neither flame nor light. (*See* ANTHRACITE.)

BLINDNESS, *blind'-ness*, is a more or less complete deprivation of vision in consequence of a diseased state of the organs of sight. Some of the blind retain a slight perception of light, or are able to distinguish the general outlines of bodies, or very bright colours, while others are entirely deprived of the faculty. Some are blind from birth; others become so in consequence of disease. In those that are born blind, the eyelids are sometimes united to each other, or to the eyeball itself; sometimes a membrane or film covers the eye; sometimes the pupil is closed, or adheres to the cornea; and sometimes the opening of the pupil is not in the right place, so that the rays of light do not fall in the middle of the eye. It may also arise from some defect of the optic nerve, or of the brain in connection with it. Blindness may result from disease of the optic nerve, or of the brain; or from an abnormal condition of the humours or coats of the eye, intercepting the passage of the light to the optic nerve. Among the diseases of the brain that may produce blindness are hydrocephalus, inflammation, congestion, softening or wasting of that organ. The eye itself may be injured by inflammation, suppuration, or cancer; spots, films, or tumours may form on the cornea, and so destroy its transparency; the humours of the eye may become thick and turbid; or the opening of the pupil may be destroyed. Blindness often arises from debility of the optic nerve, occasioned frequently by long-continued overstraining of the sight. It is in this way that certain kinds of occupations are so injurious to the sight, and often cause blindness. Hence it is, too, that in the northern regions, where the country is long covered with snow, which reflects the sun's rays, and in the sandy deserts of Africa, blindness is a common affliction. *Congenital Blindness*, that is, blindness at birth, is generally caused by some deficient development of the nerves of the eye, and may be detected by the indifference of the child to the light. In old age, blindness is usually occasioned by a drying up of the humours of the eye, a thickening of the cornea or crystalline lens, or atrophy of the optic nerve. *Day blindness* is an inability to see during the day in a bright light. Those who have been long immured in dark cells are often affected in this way. *Night blindness* is that state in which blindness comes on towards evening. This may be continued for some time; but at length the eyes become weak during the day also, and it terminates in amaurosis. Proceeding as blindness does from such a variety of causes, it is impossible to say anything here regarding its treatment, which will be found noticed in other parts of the work. (*See* AMAUROSIS, CATARACT, OPHTHALMIA, EYE, SIGHT.)

BLINDNESS, COLOUR. (*See* COLOUR BLINDNESS.)

BLINDWORM, also called the Slow-worm, a small reptile belonging to the family *Anguidæ*. There are many varieties of the species in Europe, and one of the genus is well known in many parts of Britain. It is perfectly harmless, and in no species are their any poison-fangs. Its teeth are very small, and, when irritated, it attempts to bite, but is unable to pierce the skin. Its eyes are very small, and in consequence it is popularly believed to be blind; hence the name. The blindworm lives in holes, in rocks, under stones, &c., and feeds on live worms and insects. It will not touch them when it finds them dead. Its length varies from 11 to 16 inches, and its thickness is equal throughout its length. Its colour is silvery grey, with a black line along the back, and frequently rows ot dark spots along the sides. The body is singularly brittle; the tail is blunt and easily broken off, but soon sprouts out afresh, and at the end of the year is quite renewed. The scales are small and nearly equal; the tongue is notched at the end, but not pointed and fanged. During the winter it remains torpid, and casts its skin at the beginning of summer. It is ovoviviparous, and the number of young varies from seven to twelve at a birth. One of the most interesting facts in connection with the blindworm is that it forms one of the connecting links between lizards and serpents. The bones of the head of a blindworm connect it with the lizard family; and although there are no external traces of limbs in the skeleton, there are the bones of the shoulder, the sternum or breastbone, and the pelvis, all existing in a rudimentary state.

BLISTER, *blis'-ter*, (Ang.-Sax.), a pustule or thin watery bladder on the skin containing serum. It is formed by raising the cuticle, and may be occasioned by a burn or other injury, or by a vesicatory. The term is also applied to the separation of the film or skin of plants.

BLISTER-FLY (*Cantharis vesicatoria*), an insect common to the south of Europe. Its body is used for medicinal purposes, having the effect of raising a blister when applied to the skin. It has been observed that the efficacy of the insect increases according to the heat of the country inhabited by it. (*See* CANTHARIDES.)

BLOOD, *blud* (Sax., *blod;* Germ., *blut;* Lat., *sanguis*), a red fluid circulating through the heart, arteries, and veins of animal bodies, serving for the nourishment of all their parts, and the support of life. "The blood is the life," is a Scriptural axiom. This nutritive fluid, called scientifically the *liquor sanguinis*, consists firstly of water, holding, in a dissolved condition, fibrine, albumen, potassium, and sodium, together with phosphoric acid and other substances; secondly, of corpuscles, or globules, which float in the *liquor sanguinis*. When drawn from the body, the blood undergoes a remarkable change. By degrees it gelatinizes, and forms spontaneously coagulum and serum. Coagulum consists of the fibrine and the corpuscles; serum, of water, albumen, and the various saline matters. The corpuscles are of two kinds—red and white, the red being the more numerous. The size of a red corpuscle of human blood is $\frac{1}{3200}$th of an inch in diameter. The largest corpuscles are those of reptiles. The discovery of the globules of the blood is due to Leuwenhoeck and Malpighi, whose researches were made soon after the microscope was invented. Blood is termed arterial or venous, according to the vessel in which it circulates. Arterial blood is a florid red, with a stronger odour and less specific gravity than the venous fluid. Venous blood is of a dark purple. The chief difference between arterial and venous blood, is that the former contains more oxygen and less carbonic acid than the latter. The scarlet, or arterial blood, which is one degree warmer than venous blood, owes its colour to is undergoing contact with atmospheric air in the lungs; it circulates in the pulmonary veins, the left cavities of the heart, and the arteries, by which it is distributed to the different organs throughout the body. The dark purple blood circulates in the veins, in the right cavities of the heart and lungs. (*See* CIRCULATION OF THE BLOOD, RESPIRATION.) There is, again, a difference between arterial and venous blood in respect to the gases which they contain: the first holds a supply of oxygen, the second is rendered impure by the carbonic acid with which it is loaded. (*See* ARTERY and VEIN.) Blood is the product of the elaboration of chyle; it acquires all its nutritive and life-giving qualities in respiration. By means of arterial vessels, it penetrates to all the organs, distributing nutrition to every organic tissue. It is, moreover, the principal source of animal heat: from it, also, the secretive organs derive their various products, such as saliva, bile, urine, &c. The average quantity of blood in an adult man has been calculated at 28 lbs. or pints. It has been shown that the composition of the blood undergoes a change in various diseases; and, after repeated bleedings, the number of corpuscles becomes permanently diminished. The colour, as well as the composition of the blood, varies in different sections of the animal kingdom: red in the Vertebrates and Annelides; it is white and transparent as water in Insects and Crustaceans; bluish-white in Mollusca; yellowish in Holothurians and some other Invertebrates. This difference in colour arises from the corpuscles, which are red in some cases, and in others white or straw-coloured, or bluish-white. The temperature of human blood is 90° Fah., and from 30 to 120° lower than that of other animals, the blood of birds being the highest in temperature. The chemical constituents of blood, when in a healthy condition, are—albumen, fibrin, hæmatin or colouring matter, oleic, stearic, lactic, phosphoric, sulphuric, and hydrochloric acids, in combination with soda, potash, ammonia, lime, magnesia, and a small portion of phosphorized fat. The blood also contains oxygen, nitrogen, and carbonic acid. In considering the chemical constitution of the blood, it may be regarded as consisting of two parts—the *liquor sanguinis*.

and the blood corpuscles floating therein. The *liquor sanguinis* is composed of serum, holding a small quantity of fibrin in solution. Taking the blood as a whole, Liebig gives its component parts as follows: water, 80; solid matter, 20. The solid matter, on being incinerated, give 1¼ to 1½ per cent. of ash, which consists of one-half sea-salt, one-tenth of peroxide of iron, and the rest of lime, magnesia, potash, soda, phosphoric acid, and carbonic acid.

Blood, Absorption Lines in. The colouring matter in red blood gives two wide indistinct bands in the red part of the spectrum, while deoxidised blood gives only one black band. In cases of poisoning by inhalation of carbonic oxide is found to give another set of bands. (*See also* SPECTRUM, SPECTRUM ANALYSIS, &c.)

Blood, Transfusion of.—An opinion was largely prevalent in the 15th century that the decaying vigour of the infirm might be repaired by the transfusing into their veins of the blood of young persons. It was so often fatal that it was at length suppressed; but the practice has been occasionally revived in recent times.

BLOOD-BIRD, a beautiful little bird found in New South Wales, having its head, neck, breast, and back of a rich scarlet colour. It belongs to the genus Honeysuckers (*q.v.*).

BLOOD-FLOWER. (*See* HÆMANTHUS.)

BLOOD-HORSE. (*See* HORSE.)

BLOODHOUND, *blud'-hound*, (blood; and Dan., *hund*, hound), *Canis sanguinarius*, a dog gifted with such exquisite and peculiar scent as to be able to follow the trail, for many miles, of any body bearing about it traces of fresh-shed blood, or indeed of any object to the pursuit of which it has been trained. It is also known as *Sleut* or *Sleuth* hound from the Saxon word *Sleut*, the track of a deer, in the chase of which animal it was largely used in former times. The genuine bloodhounds are large, strong, and broad-chested; the upper lip large and pendulous; the general colour a deep tan, marked with a spot of black over each eye. Formerly this creature was used in recovering escaped criminals, and it is still sometimes so employed, but very rarely, a recent instance being the capture of Fish, who murdered a girl at Blackburn. It was also used to track fugitive slaves in America and Cuba.

BLOOD-ROOT. (*See* SANGUINARIA and HÆMODORACEÆ.)

BLOODSTONE, *blud'-stone*, a variety of chalcedony, of a fine dark green colour, variegated with small bright-red spots; whence its name. It is also called *heliotrope*. Being very hard and compact, it is highly valued by seal-engravers, the devices engraved upon it being much sharper and finer than those engraved on other stones of a similar kind. Hæmatite, a brown-red mineral, consisting of sesqui-oxide of iron, is sometimes erroneously called *bloodstone*.

BLOW-FLY, *blo'-fli* (Ang.-Sax.) (*Sarcophaga carnaria*; Gr., *sarx*, flesh, *phago*, I eat). A dipterous, or two-winged insect, of the family *Muscides*, of which the common house-fly is the most familiar example. The blow-fly, which is very common in Britain on heaths, in gardens, &c., has a hairy body, with wings that have an expanse of an inch. The face is silky and yellow, the thorax grey with three small black stripes, and the abdomen is of a shining dark brown, which in certain lights has a blue tinge, and is covered with shining yellow spots. The eyes are always widely separated in both sexes. The larvæ of the blow-fly feed upon the flesh of animals, either living or dead. Sometimes they are found in meat, the carcasses of dead animals, the bodies of living earthworms, and very often upon sheep. The maggots eat their way into the skin of the sheep, which soon die, after suffering great torment. A wash of corrosive sublimate may be applied, and when the skin is much broken the wool should be clipped and an ointment of grease and tar used. Some parts of England are more infested with these pests than others, and their appearance requires the most untiring attention of the shepherd. Many blow-flies are ovoviviparous, the eggs being hatched within the body of the insect, and their reproduction is very rapid. There is a particular species of this genus which haunts burial-vaults: it is called *Sarcophaga mortua*. It differs slightly from the above, in that the abdomen is of a shining steel blue and there is on the forehead a reddish-brown line.

BLUBBER, *blub'-ber* (Ang.-Sax.), the fat of whales and other large sea-animals. Properly speaking, it is the *adeps* of the animal, and lies immediately beneath the skin and over the muscular flesh. In the porpoise it is a firm and fibrous mass, usually about an inch thick; in the whale its thickness is generally six inches; about the under lip it is two or three feet thick. The quantity of blubber yielded by one of these animals is generally from twenty to thirty tons, from which from fifteen to twenty-two tons of oil may usually be extracted. The use of the blubber to the animal seems to be partly to poise the body, and render it equiponderant to the water, partly to keep the water at some distance from the blood, and so prevent chill, and partly to reflect the hot steams of the body, and so redouble the heat; since all fat bodies are less sensible of cold than lean ones.

BLUE-BELL, a wild flower found chiefly in woods. (*See also* HYACINTH.)

BLUE-BIRD, also known as Blue Robin, Blue Redbreast, Blue Warbler (*Sylvia sialis*).—An American bird, closely resembling in its habits the English robin. (*See* SYLVIADÆ.)

BLUEBOTTLE-FLY. (*See* FLESH-FLY.)

BLUE-BREAST (*Motacilla suecica*), one of the English names of a pretty bird which forms the link between the redstart and the lapwing. It resembles both birds closely, and is sometimes called the blue-throated robin, and sometimes the blue-throated redstart. The blue-breast is found in the same countries where the red-breast is found, and particularly on the borders of forests. It is very rare in this country. The song of the blue-breast is very agreeable: it resembles two voices—one deep like the humming of a violin string, and the other soft, like the sound of a flute. The blue-breast builds its nest in the bushes and in the holes of trees, and lives upon flies, worms, and the larvæ of insects. It is also said to feed upon elder-berries. It lays six eggs, which are of a greenish-blue colour.

BLUE CARDINAL. (*See* LOBELIA.)

BLUE COPPER, a fine blue mineral, consisting of sulphide of copper. It is also known as indigo-copper.

BLUE COPPERAS, sulphate of copper, so called to distinguish it from green copperas, which is sulphate of iron. (*See* COPPER, SULPHATE OF.) It is also called blue vitriol and blue stone.

BLUE EYE (*Entomyza cyanotis*), a beautiful little bird found in New South Wales, a species of the *Honey Sucker*, and sometimes called the Blue Cheeked Honey Eater. It also feeds on insects and berries.

BLUE JOHN, a name given by miners to the blue variety of Derbyshire or fluor spar. It occurs in cubical crystals or in granular crystalline masses, and is much used for making vases, cups, and other ornaments. It is found principally at the Blue John mine at Castleton, in Derbyshire, and in the lead mines of Alston Moor, in Cumberland. (*See* FLUOR SPAR.) This material is daily becoming scarcer. It requires great skill in working, owing to its brittleness.

BLUE TITS. (*See* TITS.)

BLUE THROAT (*Sylvia Suecica*), also called Blue-Breast, Blue-Throated Warbler, Blue-Throated Robin-becfin, and Beccafico. A summer bird of passage, well-known in many parts of Europe, but rare in Britain. It much resembles our Robin, but has a blue, instead of a red breast. (*See* also SYLVIADÆ.)

BLUE WING, an American bird somewhat resembling our wild duck, highly esteemed for the table. As its name implies, the principal colour of its plumage is blue, except the back which is brown mixed with green. The lower parts are reddish-orange, spotted with black. It is very common in the marshes of the Southern States.

BLUSHING, *blush'-ing* (Dan., *blussen*, to blaze or glisten), is a sudden reddening of the face, excited by a sense of shame, confusion, or surprise. It is produced by an increased flow of blood into the capillary vessels of the face and neck; and besides reddening, it creates a sensation of heat in those parts. It is occasioned by the mental shock acting upon the brain, and, withdrawing the nervous energy which ordinarily contracts the muscular coats of the bloodvessels of these parts, whence the blood is permitted to flow with greater violence through the vessels.

BO TREE, *Ficus Religiosa*, a common name given in Ceylon to the *Peepul* (q.v.), a sacred tree to the Buddhists, planted close to the temples. The Bo Tree near the city Anarajapoora is reported to be the oldest in the world. It was planted 288 B.C., and is now, therefore (1882), 2170 years old. It is supposed to have sprung from a branch of the identical fig-tree under which Gotama Buddha reclined at Uruwelaya when he underwent his apotheosis. Sir James Emerson Tennent, in his work on Ceylon, describes this particular tree, and gives conclusive reasons for believing in its great age. He finds it mentioned in historic documents of centuries ago.

BOA, a name popularly applied to all large serpents which kill their prey by twining round and crushing it, but restricted by zoologists to that section of them which have plates under the tail singly. They are all found in the Western Hemisphere, those in Asia, Africa, &c., being known as pythons (which *see*). These have the plates on the under surface of the tail double. The boas feed chiefly on small quadrupeds in search of which they often ascend trees and suspend themselves from the branches by the tail, and thus hanging motionless they await the coming of their victim. The prehensile power of the tail is also supplemented by two spine-like hooks occurring on the lower part of the body, which they fasten at will on the boughs of trees. These claws are connected with the bones of the main skeleton, and form a characteristic of the *Boidæ* or boa family.

Boa Constrictor.—This name is popularly applied indiscriminately to any huge serpent, but particularly it designates an enormous reptile found in the interminable marshes of New Guinea, and other hot portions of the American continent. The branches of the upper and lower jaw of this creature, as well as the bones of the palate, are armed with recurved and pointed teeth, forming four rows above and two below. The pedicle of the lower jaw is movable, which itself is almost wholly suspended to another bone, analogous to the mastoid, attached to the skull by muscles and ligaments. The branches of the lower jaw are not united, and those of the upper jaw are attached to the intermaxillary bone only by ligaments, so that these animals can expand the mouth sufficiently to swallow bodies much larger than themselves. The ground-colour of the boa is most frequently a yellowish-grey; and disposed along the entire length of the back is a series of chain-like reddish-brown variegations, leaving large open oval spaces of the ground-colour at regular intervals. The boa constrictor is, however, not the largest of the species, being seldom more than 12 feet long. The number of species, their habits, &c., are not yet well ascertained. Boas have been reported, by credible authorites, as reaching the enormous length of thirty feet; and it is no uncommon thing to read of their reaching *sixty* feet in length. Indeed, if we go back to the period when Rome was a great city, we shall read of one that had its lair on the shores of the Bagradas, and that measured a *hundred and twenty* feet in length. All the weapons the army of Regulus was able to bring against the monster were of no avail, and it was not slain till it had destroyed several battalions, and the siege-engines, loaded with ponderous stones, were levelled against it. It is certain, however, that this boa, if not a pure invention, has been lengthened outrageously. Actually, boas possess enormous strength, appetite, swallow, and powers of digestion. They have been known to swallow whole goats and pigs, beginning the prey at the muzzle and gradually sucking it down. A boa constrictor, confined in the Jardin des Plantes, swallowed the blanket provided for its warmth, and, after retaining the indigestible meal for four weeks, disgorged it: it died shortly afterwards.

Water Boa or Anaconda (*Ennecteus murinus*) is the largest serpent in the world, attaining, it is said, a length of 40 feet. Its habitat is the marsh country of Brazil and also Guiana. It is exceedingly voracious, feeding on fishes and animals that come to the water to drink. It also attacks young cattle, and, when hard pushed, either by hunger or fear of capture, will face man. The spotted boa (*Boa scytale*) of South America, the ringed boa (*Boa cenchria*) of the same country, the embroidered boa (*Boa Phrygia*), the canine boa (*Boa canina*), and the garden boa (*Boa hortulana*) are all members of the same family. The embroidered boa is supposed to be the most splendid of the tribe; it is about four feet long, the ground-colour is white, the back tinged with golden brown, while along the whole of the upper part is a series of black variegations bearing a striking resemblance to embroidery.

BOAR, *bore*, the male of swine. All the varieties of the useful genus *Sus* that are now seen in civilized countries, owe their origin to the wild boar, which is a native of nearly all the temperate parts of Europe and Asia. It was formerly a beast of chase in the woods of this country, and, at the present day, it is hunted in India and in many parts of Europe. It is generally more gaunt and bony than the common hog, and its muscular strength is greater. When about a year or two old, the hide has a yellowish-brown hue; but, in time, this changes to a dark-brindled grey. There is a fine soft hair, of a woolly nature, next the skin, between the bristles. The snout of the wild boar is rather longer than that of the common hog; but the chief difference lies in the savage disposition of the former and the extraordinary length of his tusks. The females are mild, except when their young are attacked. The tusks of the wild boar are long, curved, and sharp, and are capable of inflicting severe and fatal wounds. After they are five years old, however, these tusks begin to turn up, and are not such formidable weapons. Buffon says of wild boars: "These animals, when they have young, form a kind of flock, and it is upon this alone that their safety depends; when attacked, the largest and strongest front the enemy, and by pressing all round against the weaker, force them into the centre." On account of the excitement and danger connected with wild-boar hunting, it has been at all times a very favourite sport. The ancient Romans used to hunt them on foot with large spears. In later times, William the Conqueror punished, with the loss of their eyes, all persons convicted of killing the wild boar, the stag, or the roebuck. (*See* HOG, SUS.)

BOAR-FISH (*Capros*), a fish of the Dory family which takes its name from the resemblance borne by its mouth to the snout of the hog. Its fins are covered with rough scales, and it has no spines along the dorsal or anal fins. The eyes are very large, and placed far forward. It is of a carmine colour, lighter below, and with seven transverse orange bands on the back. It is a well-known inhabitant of the Mediterranean, and is very rarely seen on the British coast. Its flesh is of poor quality.

BOATBILL, *bote'-bill*, (*Cancroma cancrophaga*), a bird about the size of the domestic hen, an inhabitant of Cayenne, Guiana, and brazil. Its beak resembles a boat reversed, having a strong keel-like ridge down the middle of the upper mandible. The food and general habits of this bird place it among the herons. It chiefly lives by the sides of rivers.

BOAT FLY (*Notonecta*), an aquatic insect of the family *Hydrocorisæ* or Water bugs. Its form is somewhat like that of a boat, and is eminently adapted for progression on the water. It swims on its back and also floats and rests on the water in this position. There are not many known varieties, the commonest in Britain being *N. Glauca*, the *Water-Boatman*. It is about half-an-inch long, and varies greatly in colour; but, as a rule, exhibits a tinge of green. Their food consists principally of insects like themselves, and indeed they often devour their own species. They have a hollow between their folded wings, which they can store with air for their respiration when they descend below water.

BOBOLINK, *bob'-o-link*, (*Dolichonyx oryzivorus*), otherwise named the Reed-bird or Rice-bird, an American bird, nearly allied to sparrows and buntings. The plumage of the males in summer is very handsome, consisting of black, yellow, and white; and their song is very musical and voluble, on which account they are in great demand as cage-birds. The bobolink is a bird of passage, going southward even as far as the West Indies in winter. The flesh of the bird is considered a delicacy.

BODE'S LAW, *bodes'-law*, an arithmetical formula which approximately expresses the distances of the planets from the sun. Kepler led the way to its discovery in an attempt to find a general law by which the distances of the planets from the sun were governed, by showing that there was an undue space between the orbits of Mars and Jupiter, in comparison with the relative distances of the planets from the sun. This caused him to conjecture that a planet hitherto unobserved really existed, having its orbit between those of Mars and Jupiter; and in 1772, this formula (since known as Bode's law) was enunciated by Johann Elert Bode, a German astronomer, who boldly declared that Kepler's idea would be found to be an actual fact. The law itself is as follows:—Supposing 4 to represent the distance of Mercury from the sun, the distance of the other planets is obtained by adding to this number a geometrical series, of which 3 is the first term, increasing by the ratio 2. Thus, the distances of the planets from the sun are respectively represented as follows:

NAME OF PLANET.	Distance according to Bode's Law.
Mercury	$4 = 4$
Venus	$4 + 3 = 7$
The Earth	$4 + (3 \times 2) = 10$
Mars	$4 + (3 \times 4) = 16$
Supposed Planet (asteroids)	$4 + (3 \times 8) = 28$
Jupiter	$4 + (3 \times 16) = 52$
Saturn	$4 + (3 \times 32) = 100$
Uranus	$4 + (3 \times 64) = 196$
Neptune	$4 + (3 \times 128) = 388$

These theoretical distances very closely approximate to the real distances. That there must be some truth in the system above given, is proved by the discovery of the sixty-nine asteroids (*see* ASTEROIDS) since 1800, which fill the place that Kepler supposed to be occupied by a planet. There is no very great deviation from the numbers arbitrarily laid down, except in the case of Neptune. The satellites which revolve round Jupiter and Saturn follow a similar law in their respective distances from their planets.

BODY, *bod'-e*, a term very variously used. In Physics it denotes a solid, extended, palpable substance of three kinds; as a soft body—one which, yielding to a blow, undergoes a change; a hard body—one which remains unaltered after being struck; an elastic body—one whose form changes upon being struck, but recovers again when the impelling force is removed. With respect to animals, body signifies the frame, the material substance, in contradistinction to the living principle in beasts and the soul in man; in other words, matter as opposed to spirit.

Bodies, Regular, in Geometry, a term applied to five solids; as the icosahedron, with twenty regular pentagonal faces; the dodecahedron, with twelve triangular faces; the octahedron, with eight triangular faces; the cube, or hexahedron, with six square faces; and the pyramid, or tetrahedron, with four triangular faces.

BŒHMERIA, *be(r)-meer'-i-a*, a genus of plants belonging to the natural order *Urticaceæ*. From several species valuable fibres are obtained. *B. frutescens*, or *puya*, a plant growing wild in Nepaul and Sikkim, is the source of the celebrated Pooah fibre, which rivals the best European flax for tenacity. This species attains the height of six or eight feet; but the stem is usually very slender. It is cut down for use when the seed is formed; the bark is then peeled off, dried, boiled with wood ashes, and beaten with mallets, to separate its component fibres. *B. speciosa*, the wild rhea, also yields a very strong fibre, which is much used in the East. *B. nivea*, the Tchou Ma of the Chinese, is now known to yield the fibre used in the manufacture of the beautiful fabric called Chinese grass-cloth. The species constituting this genus were formerly regarded as species of *Urtica*, the nettle.

BOERHAAVIA, *be(r)-ha'-vi-a* (so named after Boerhaave, the celebrated physician), a genus of plants belonging to the natural order *Nyctaginaceæ*. The species are employed medicinally, both in Peru and the East Indies, having emetic and purgative properties. *B. tuberosa*, a native of Peru, is employed as a culinary vegetable.

BOG, *bog* (Celtic, soft), the name commonly given to a wet spongy morass, composed, for the most part, of decayed vegetable matter. The Bog of Allen is the most extensive of the numerous bogs found in the British isles. Chatmoss, in Lancashire, is another celebrated bog, being twelve square miles in extent. The origin and composition of bogs will be found to be fully treated of under the head PEAT.

Bog-bean. (*See* MENYANTHES.)

Bog-butter, a mineral substance found in some of the bogs of Ireland. It is evidently of vegetable origin, and produced by the decomposition of peat. It resembles, in some respects, bitumen and asphalt. It becomes liquid at 124° Fah., and is soluble in alcohol.

Bog-head Mineral, also known as the Torbane-head mineral (which *see*).

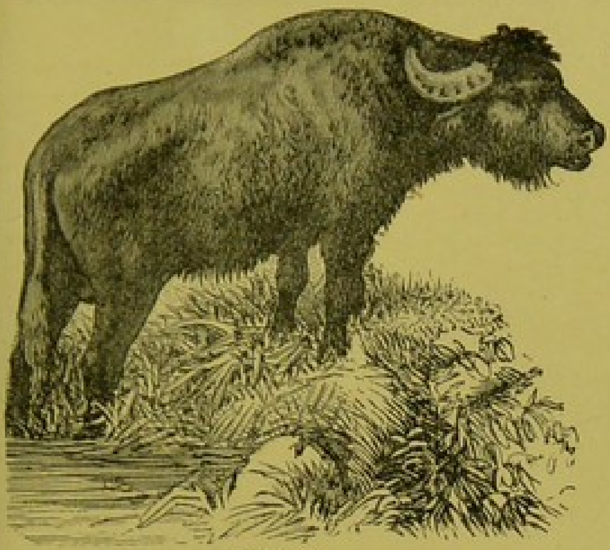
Bog Iron-ore, a ferruginous deposit found at the bottom of bogs. It consists mainly of peroxide of iron, and is formed by the subsidence of the iron oxides and carbonates held in solution by the bog water. It occurs in some parts of America in such large quantities as to be commercially valuable. When smelted, it yields good iron. It is of a reddish-brown colour, and has been occasionally used as a pigment. Some varieties of bog iron-ore contain phosphates. Ehrenberg came to the conclusion that the mineral is formed of the shields of animalculi.

Bog-oak, Bog-wood, a name applied to the trunks and large branches of oaks, firs, and other trees found in the Irish and Scotch bogs. It derives its intense black colour from being impregnated with iron. It is very hard, and is capable of receiving a high polish. It is much used in Ireland, in combination with gold and silver, for articles of jewellery.

BOHEMIAN WAXWING, *wax'-wing* (*Bombycivora garrula*), a bird about the size of the starling, more distinguished for its pretty plumage and graceful form than for sweet song. It only visits Britain in the winter. The country in which the young are reared is not known with certainty. M. Temminck states that the European waxwing breeds in the eastern part of the north of Europe, and lives in the northern parts of Asia.

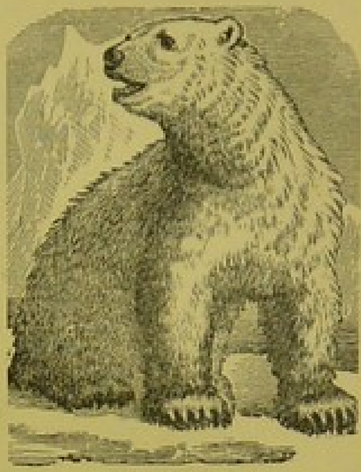
BOIL, *boil* (Latin, *Bulla*, a bubble), called also *furunculus*, from the Latin *furo*, I rage, on account of the violent heat and inflammation attending it, is a hard painful tumour of the skin and the subjacent cellular tissue. It makes its appearance as a small, hard, inflamed spot, and gradually enlarges into a painful tumour, having a white conical centre, surrounded by a hard inflamed base, and varying in size from the bulk of a pea to that of a pigeon's egg. It proceeds to suppuration, and discharges a few drops of purulent matter commonly mixed with blood, and a central mass called the *core*. This last often lies deep, and causes considerable pain before coming away; but, without its removal, the abscess will not heal. Boils, though generally very troublesome, are not attended with danger. They take their rise in some disordered state of the digestive organs; and hence it is necessary that the bowels be kept open, but not purged, and tonics are given to improve the digestive powers. The diet should be plain and simple, and stimulants ought to be avoided. In dealing with the boil itself, suppuration is to be hastened and perfected by means of linseed-meal or bread poultices; and as soon as the prominent part of the swelling becomes soft, a free opening should be made into it with a lancet, and as much matter as can be pressed out of it by tolerably firm pressure should be removed, together with the core; or the poultices should be continued until the core is drawn out, when the wound will speedily heal. *Old People's Boil* usually occurs on the back of the neck in elderly people after some disorder of the stomach. *Night boils* (*epinyctes*), attack some persons for a length of time. They are troublesome little pustules which arise during the night and accompanied by languor and nausea. Slightly laxative medicine, &c., as mentioned above, will usually rid the system of these unpleasant affections.

BOILING-POINTS, *boil'-ing points*. A liquid is said to boil when, by means of heat, it is made to assume a constant state of ebullition by the formation of bubbles of its vapour. The boiling-points of liquids differ according to their chemical constitution; in many instances, in direct ratio to the differences in their composition. The boiling-point of the same liquid may vary under different circumstances; such as the pressure on its surface, the amount of attraction exerted by the vessel containing it, or by salts held by it in solution. Boiling, or the emission of steam in bubbles, consists in the formation of a vapour of equal elasticity to that of the atmosphere, which exerts its pressure on the surface of the liquid. It therefore follows that any lessening or increasing of the pressure of the air is accompanied by a corresponding depression or elevation of the boiling-point. This fact is made evident by the familiar experiment of placing warm water under the receiver of an air-pump, when, on exhausting the air, ebullition takes place from the diminished pressure. Liquids, in general, boil from 60° to 140° lower than their ordinary boiling-point when heated *in vacuo*. This property is made use of in the manufacture of certain medicinal preparations, the properties of which would be destroyed by exposure to a temperature of 212°. Advantage has been taken of this property of fluids in the measurement of heights. M. Saussure found that on the summit of Mont Blanc, which is nearly three miles above the level of the sea, water boiled at 185° Fah.; and M. Wisse observed the boiling-point of water to be 185° Fah. on Mount Pechiacha, while the barometer stood at 17 inches. From these facts it has been calculated that for every difference in height of 596 feet, a variation of 1° Fah. in the boiling-point is produced. It has also been ascertained that a variation of one-tenth of an inch in the barometer produces a difference of more than a twentieth of a degree Fah. in the boiling-point. The contrary property of increase of pressure causing elevation of the boiling-point, is evident from the above considerations. Papin's digester is an example of this. By confining water in an air-tight vessel, it may be heated to a temperature only limited by the strength of the vessel. This property is taken advantage of in the preparation of gelatine from bones, which are heated to a temperature much higher than 212° Fah. By this means the gelatine is easily



BUFFALO.

BUTCHER BIRD.

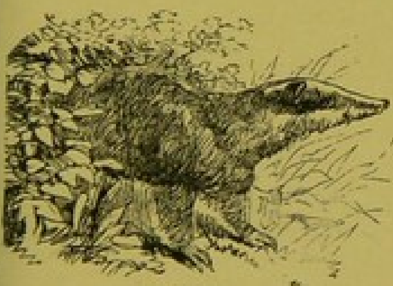


POLAR BEAR.

DWARF BIRCH.

BANYAN TREE.

BANANA

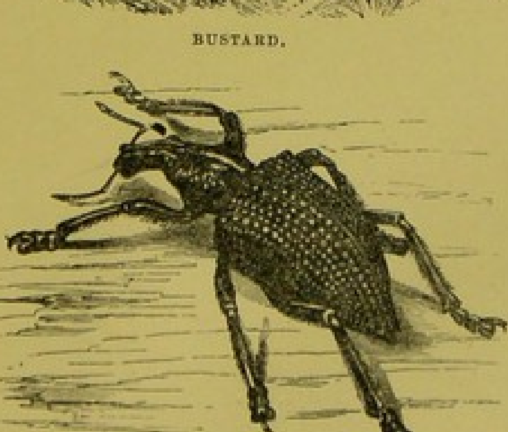


BADGER.

BUSTARD.

BABOON.

BUCKTHORN.



DIAMOND BEETLE.

COMMON BERBERRY.

separated from the earthy matter, although the bones might be boiled for hours at 212° Fah. without any such effect taking place. The attraction of a fluid for the surface of the vessel in which it is boiled has a great influence on the boiling-point. Water boils at 212° in a metallic vessel, in a glass vessel at 214°, while in a vessel varnished inside with shell-lac the heat may be raised to 220° without ebullition taking place. Also when water contains salt, sugar, or other substances in solution, it requires a higher temperature. From the experiments of Kopp and others, it has been discovered that an exact ratio exists between the chemical constitution of certain liquids and their boiling-points at the same pressure. Thus methylic, ethylic, propylic, and butylic alcohols differ from each other by an increment of C_2H_2, and their boiling-points differ by an increment of 31·4° Fah. Another example of this is shown in the hydrocarbons benzole, toluole, xylole, and cumole, the difference in their composition being C_2H_2, while the difference of their boiling-points is 41° Fah. The same relation runs through the acids, ethers, aldehyds, and salts of these bodies. (*See* also EBULLITION.)

BOILING SPRINGS. (*See* GEYSER.)

BOKHARA CLOVER. (*See* MELILOT.)

BOLDERBERG BEDS, *bol'-der-bairg*, a typical group of tertiary sands and gravels occurring in the Bolderberg hill, about 40 miles from Brussels.

BOLE, a term applied to friable clayey shale or earth, containing silica and alumina, and coloured red or brown by peroxide of iron.

Bole, Armenian, *bole* (Swed., *bol*), a dark-red earthy mineral consisting of hydrated silicate of alumina, mixed with peroxide of iron in large quantities. It also contains traces of lime and magnesia. It is occasionally used for coarse paint and for stage purposes; also for colouring tooth powders, false anchovies, &c. When the amount of magnesia is such as to cause it to feel greasy, it is termed *mountain soap*, or *fett-bol*.

BOLETUS, *bo-le'-tus*, a genus of *fungi*, division *Hymenomycetes*, sub-division *Polyporei*, which may be distinguished from *Agaricus* by the absence of gills, the under-side of the cap or pileus being covered by a porous layer composed of innumerable short tubes united together. Some of the species are edible, though they are all set down as mere toadstools by the mushroom-gatherers of this country. *B. edulis*, the *Ceps ordinaire* of the French markets, is much used throughout the European continent. It grows in woody situations and attains a considerable size, the cap being usually six or seven inches across. In moist, warm summers, it usually grows in considerable quantities, but in Britain this species is seldom seen. The colour of the cap ranges from light brown to brownish-black, while that of the layer of tubes beneath is at first white, then yellow, and finally yellowish-green. The stem is thick, solid, and beautifully reticulated. To prepare the fungus for the table, the layer of tubes, the skin, and the stem, must be thrown away, for nothing but the firm and delicate flesh of the cap is to be eaten. This may be either eaten raw with salt and pepper, or cooked like a common mushroom. Many other species are usually found exposed for sale in the French markets.

BOLOGNA PHOSPHORUS, OR STONE, *bo-lone'-ya*. Heavy spar, or sulphate of baryta, on being ignited with a small portion of carbon, and exposed to the sun's rays, acquires phosphorescent properties, and is called Bologna phosphorus, from having been first discovered in that city. The name is also applied to the same mineral when calcined, powdered, and made into little lumps with gum-water, for after being exposed to strong sunshine it likewise exhibits phosphorescent properties.

BOMBACEÆ, *bom-bai'se-e*. (*See* STERCULIACEÆ.)

BOMBARDIER BEETLE, a name applied to many coleopterous insects of the tribe *Carabidæ*. They are divided into two genera—the *Brachinus* and the *Aptinus*; the latter has no membranous wings under the wing-sheath. Those found near the tropics are large and brilliantly coloured, but those found in this country are generally small. They are called bombardier beetles on account of a remarkable property they possess of violently expelling a pungent acrid fluid, which, if the species be large, has the power of producing discolouration of the skin, similar to that produced by nitric acid. It also changes blue vegetable colours to red, and then to yellow. The most common English species is little less than half an inch long; if irritated, it will make more than twelve rapid and noisy discharges. The bombardier beetle is generally found under stones, and occurs plentifully in chalky districts.

BOMBAY DUCK, *saurus ophiadon*, the name given to a marine fish found on the coasts of India, and highly esteemed as an article of food because of its rich flavour. When salted and dried it is largely exported inland. It is of elongated form, with large fins and immense mouth, armed with long and barbed teeth. *Bummaloti* is a name by which it is also known.

BOMBAX, *bom-bax'*, a genus of plants, the type of the tribe *Bombaceæ*, natives of South America and India, and commonly known as silk-cotton trees, owing to their seeds being covered with long silky hairs. These hairs cannot be spun into thread, like those of ordinary cotton; but they are sometimes used for stuffing beds and cushions. The American tree *B. Ceiba*, and the Indian tree *B. Pentandrum*, are remarkable for their prodigious height. The bark of the latter is said to be emetic.

BOMBYX (*See* SILKWORM.)

BONASIA, *bon-a'-shi-a*, a genus of birds of the grouse family (*Tetraonidæ*), characterized by having the lower part of the shank destitute of feathers, also by the elongated feathers of the upper part of the head. To this genus belongs the Hasel Grouse, found in nearly all parts of the Continent of Europe, a bird about the size of a partridge, mottled with grey and reddish-brown plumage, and with a black near the extremity of the tail feathers. The Ruffled Grouse of America, a large bird, known in some parts of the United States indifferently as pheasant or partridge, belongs to this genus.

BONASSUS, *bo-nas'-sus*. (*See* BISON.)

BONE, *bone*, is a hard complex structure forming the framework or skeleton of the body in man and the higher animals. It is confined to vertebrate animals; and even in the lowest order of this class, the cartilaginous fishes, it is entirely wanting. The bones form a framework for the moulding and adequate support of the soft parts of the body; cavities for the lodgment and protection of delicate organs; joints for locomotion, and levers for the action of the muscles. They are always in the interior of the body, and even when they approach the surface are covered by some soft membrane, muscle, skin, &c. The first development of bone is commonly—though not always, as in the bones of the head—preceded by the formation of a cartilaginous structure, occupying the place which the bone is afterwards to take. It is supposed that the bone is formed by the ossification of the cartilage; but some physiologists have doubted whether this is the case. The process of bone-formation always commences in the immediate neighbourhood of blood-vessels, which pass down into canals excavated in the substance of the cartilage, and lined by a continuation of its investing membrane. Hence the spots where these vascular canals are especially developed are termed centres of ossification. One of these is usually found in the centre of the shaft of a bone, and one at each end, with an additional one for any considerable projection or process. In the flat bones there is generally one in the middle of the surface, and one in each of the principal processes. Until the bone attains its full dimensions, the parts which contain distinct centres are not connected by osseous union, but only by cartilage, so as to allow an increase in the size of the bone by the growth of cartilage between its detached portions, which gives place to bony structure, when there is no further need of increase. There exists a close correspondence between the number of ossific centres in the early condition of the skeleton of all vertebrated animals. The growth of bone is effected by the addition of new tissue in three different modes:—1, By the development of new bone in the cartilage between the parts yet remaining separated; 2, by the development of new bone in the membrane covering the surface; and 3, by the interstitial formation of new layers within the canals of the osseous fabric already developed. The perfect reparation of bone after severe injuries, effected by the development of new osseous tissue in the substance of membrane or cartilage formed in the seat of injury, is one of the most remarkable features of its character. Bones are so constituted that a constant process of deposition and absorption is carried on in them, as in the softer tissues, modelling the shaft into its requisite proportions during the successive stages of growth. It is much more actively carried on in youth than in middle life, and is greater in the vigour of manhood than in old age. Bones increase in length not so much by interstitial deposit, as by addition to their ends; that is, by progressive ossification of the layers of cartilage which intervene between the ends of the shaft and the epiphyses. Bones are largely supplied with blood-vessels. The solid osseous texture which forms the cylindrical shafts of the long bones and the thick external plates of the denser flat bones is penetrated by a series of canals, termed Haversian (after their discoverer, Clopton Havers, an old English anatomist), which form a network in its interior, and serve for the transmission of blood-vessels into the interior. These canals, in the long bones, run for the most part in a direction parallel to the central cavity, and communicate with this, with the external surface, and with each other, by frequent transverse branches. They vary in diameter from $\frac{1}{200}$ to $\frac{1}{2500}$ of an inch, averaging about $\frac{1}{500}$; and are smallest near the outer surface, where the bone is most compact; but become gradually larger towards the interior. In the long bones of man and of most mammalia there is a central cavity, which is filled with the fatty substance known as marrow; and the space in which the marrow lies is called the medullary canal. This cavity does not exist in the bone in its early state, but is formed by the removal of the cancellated osseous tissue first developed in its interior. Among birds, however, the central cavity, instead of being occupied by marrow, is filled with air, and communicates with the lungs; so that the membrane lining it becomes an auxiliary organ of respiration; whilst the lightening of the bones thus produced diminishes their specific gravity. Bones are covered externally by a strong fibrous membrane termed the periosteum, which serves to protect the blood-vessels entering them. The medullary canal is also lined by an extremely delicate membrane, termed the medullary membrane, which supports the marrow, and provides a stratum for the subdivisions of the medullary artery before they penetrate the contiguous osseous substance. The Haversian canals are also lined by a similar membrane. Though bones possess little sensibility in health, yet, when diseased, they become highly sensitive, a manifest indication that they are supplied with nerves. These may, indeed, be traced into some of the minute foramina on the shaft of a long bone, but more easily into the articular ends. A nerve also enters the medullary canal with the nutrient artery of the medulla, and divides, like the artery, into an ascending and descending branch. Bone is composed of a basis of animal matter, impregnated with "bone-earth," or phosphate of lime. The first ingredient makes it tenacious and elastic; the second gives it the requisite hardness. These may be separated from each other: the latter may be entirely dissolved away, by soaking the bone in dilute muriatic or nitric acid, when a substance of cartilaginous appearance is left; the former, by subjecting the bone to a heat sufficient to decompose the animal matter, when we obtain the whole calcareous substance *in situ*. The animal portion of a bone forms about one third, the earthy about two thirds; and the relative proportion of the two elements is said to differ little in different classes of animals. It is not yet a settled point whether the proportions vary at different periods of life; bnt the general opinion is that they do, the animal element predominating in early life, the earthy in old age. The bony framework of the higher classes of vertebrate animals presents very nearly the same chemical characteristics in most individuals. Bones, when dried at 212° until they cease to lose weight, consist of one third ossein, or organic matter, and two thirds of phosphate and carbonate of lime and phosphate of magnesia. Ossein, when boiled in water, gradually dissolves, leaving a small quantity of fatty and vascular matter floating on the solution, which, on cooling, gelatinizes, forming a weak glue or size, consisting of nearly pure gelatine. The earthy matter may be separated from the ossein, either by means of an acid, or else by boiling in water in a Papin's digester, at a temperature over 300°, the gelatine being only dissolved at that heat. The mineral constituents of bone are used as manure and in the manufacture of cupels. When bones are distilled in close vessels, at a gradually increasing temperature, oily matters, mixed with carbonate of ammonia, pass over, leaving behind bone-black, or animal charcoal.

BONGAR, *bon'-gar*, a genus of venomous serpents, natives of the East Indies, where they are known as Rock Snakes. One species, *B. annularis*, attains a length of six feet, and is surrounded with black and yellow rings. The head is broad and depressed.

BONGARDIA, *bon-gar'-di-a*, a genus of herbaceous plants of the natural order *Berberideæa*, natives of the East. The tubers of one species are eaten, either boiled or roasted, in Persia, and the leaves of another species, having a slightly acid taste, are eaten as salad.

BONITO, *bon'-e-to* a name applied to several fishes belonging to the mackerel family, or *Scomberidæ*. There are three varieties—the *Thynnus pelamys*, the *Pelamys sarda*, or Belted Bonito, and the *Auxis vulgaris*, or Plain Bonito. The *T. pelamys* resembles the tunny, and is not unlike a large mackerel. In tropical climates it is found in large numbers, and is well known to sailors as one of the fishes constantly seen in pursuit of the flying-fish. It is a very pretty fish, of a rich blue colour, with four dark lines stretching from the pectorals to the tail, on either side of the belly. Its average length is about two feet, and it is generally caught with an imitation flying-fish as a bait. The belted bonito is common in the Mediterranean and Black Sea. The plain bonito is also found in the Mediterranean, where its flesh is salted or pickled, and used for food. It is occasionally taken off the English coast.

BONY PIKE, *pike* (*Lepidosteus osseus*), an elongated pike-like fish, one of the few living representatives of the fossil Ganoid fishes inhabiting the warmer lakes of America. The jaws of this fish are usually produced into a long narrow snout, presenting considerable resemblance to that of the Gangetic crocodile. The vertebral column presents a structure such as is met with in no other fishes, being regularly articulated, and the head is capable of a remarkable degree of motion. The body is covered with bony square scales. The flesh of the bony pike is considered a delicacy.

BOOBY, *boo'-be* (*Sula fusca*), a name given to a large bird, a species of gannet. It is not quite so large as a solan goose, and it inhabits the desolate islands and unfrequented coasts of most warm climates. It has received its name in consequence of its apparent stupidity, in sitting quietly and allowing itself to be knocked on the head, or be taken away by any one attempting it. It is very powerful on the wing, and feeds on fishes, which it watches while flying close to the surface of the water, and then catches by suddenly diving down upon them. Its colour is dark brown, rather white underneath. Its bill is much longer than its head, and its gullet is so expansible that it is able to swallow fishes of large size. The male and female resemble each other closely in appearance, and the latter only lays one egg. It is found in almost all tropical and sub-tropical shores, and sometimes at a considerable distance from land. The flesh of the booby, like that of all birds that live on fish, is not agreeable when cooked. (*See* GANNET.)

BORACIC ACID, *bo-ras'-ik* (from Arab., *baurac*, a species of nitre) (BO_3).—This acid, which may be regarded as a teroxide of boron (*see* BORON), is the only known compound of oxygen and boron. It occurs in nature in certain volcanic districts, where it issues from the earth in jets mixed with steam. In Northen Italy, these jets, or *fumerolles* as they are called, are conducted into artificial basins or small ponds. One of the chief places where the jets occur is Monte Cerboli, described in local legends as the entrance to the infernal regions. The boracic acid remains dissolved in the water, which is periodically removed, and evaporated in shallow leaden pans, which are heated by other *fumerolles* in the neighbourhood. During the evaporation, great quantities of sulphate of lime are deposited, which require removal from time to time. About 1,200 tons of crude boracic acid are annually exported from this district. The crude acid is contaminated with 25 per cent. of sulphate of ammonia and alumina, and other saline impurities. Boracic acid is used principally for making borax, or biborate of soda. (*See* BORAX.) Boracic is formed in the laboratory by dissolving purified borax in four parts of boiling water, and adding to the hot solution a quantity of sulphuric acid, equal to one-fourth the borax used. On cooling, boracic acid crystallizes out in white, feathery, crystals, containing three equivalents of water. When a solution of boracic acid is evaporated, a certain quantity of the acid rises with the steam; and this is the cause of the *fumerolles* described above. Boracic acid is used as an ingredient in the preparation of glaze for pottery, as a flux, and in the manufacture of wicks for stearine and composite candles.

BORACITE, *bor'-a-site*, an anhydrous borate of magnesia, found at Luneberg, in Lower Saxony, and one or two other localities in that neighbourhood. It occurs in cubical crystals, and, when heated, possesses electric properties, the opposite angles of the tube being found to develop opposite forms of electricity.

BORAGE, *borage*. (*See* BORAGO.)

BORAGINACEÆ, *bo-raj'-i-nai'-se-e*, the Borage family, a natural order of dicotyledonous plants in the sub-class *Corolifloræ*, characterized by an ovary deeply divided into four lobes, from the middle of which a single style arises. The species are herbs or shrubs, with alternate leaves, usually rough with hairs. The flowers are regular and symmetrical; the calyx is persistent, and divided into either four or five segments; the corolla has the same number of lobes, and usually scales in the throat; the stamens rise from the corolla, are equal in number to its lobes, and alternate with them. The fruit consists of two or four distinct achænia placed at the bottom of the persistent calyx. There are 54 genera, which include nearly 700 species, chiefly natives of the temperate regions in the northern hemisphere. Among them we find many well-known plants, such as the Forget-me-not, Borage, Comfrew, and Alkanet. (*See* ANCHUS, BORAGO, MYOSOTIS, SYMPHYTUM.) The various species are remarkable for their mucilaginous properties; some have roots which are valuable dyeing agents.

BORAGO, *bo-ra'-go* (*bor*, for Lat., *cor*, the heart, *ago*, I cheer; because it was believed to exhilarate the heart), a genus of plants forming the type of the natural order, *Boraginaceæ*. The species *B. officinalis*, commonly known as Borage, is now naturalized in England and most of the countries of Europe, but was at a remote period confined to Asia Minor. It is characterised by a wheel-shaped corolla with a very short tube, the mouth of which is closed by scales: by five stamens with forked filaments, the inner arms of which support the anthers; and by these anthers being connivent around the style, in the form of a cone. The entire plant is rough with hairs, and has rather a coarse appearance; but its flowers are very beautiful, being of a fine blue colour. The young leaves are added to a *cool tankard*, or draught made of wine or cider, with water, lemon, and sugar. The flowers are used on the Continent to ornament salads, and the tender tops are sometimes boiled in soups.

BORASSUS, *bo-ras'-sus* (Gr., *borassos*, the skin of the date), a genus of Palms, consisting of but one species, which is found in every part of India. This has been named *B. flabelliformis*, and is commonly known to the European inhabitants as the Palmyra. Its stem attains a height of from 25 to 40 feet, and bears upon its summit a magnificent coronal of fan-shaped leaves. The fruit is about the size of a child's head, and, when very young, contains a sweet pulp, which may be eaten. From the juice obtained from this plant, large quantities of an intoxicating drink are prepared by the natives. The fibres of the leaves are used for cordage, and the outer wood of the stem for bows.

BORAX, *bor'-ax* (Arab., *baurac*, a species of nitre), a compound containing boracic acid (which *see*) and soda, found in nature as a saline incrustation on the shores of lakes in Persia and Tibet. It is said to have been known to the ancients as *chrysocolla*, and to have been used in soldering, brazing, and casting metals. It was formerly imported from the East in the crude state, under the name of *tincal*, which contained borax in combination with various substances of a saponaceous nature. It was purified by being heated with lime or soda until the whole of the soapy matter and other impurities were separated. Borax is now mostly prepared by fusing two parts of boracic acid, obtained from the Italian lagoons (*see* BORACIC ACID), with one part of soda-ash. The mixture is thrown on the floor of a reverberatory furnace, and heated until all effervescence has ceased. The fused mass is lixiviated and boiled until the impurities are precipitated: it is then decanted, and set aside to crystallize slowly. It crystallizes in rectangular hexagonal prisms, containing 10 equivalents of water. A new source of borax has lately been discovered in a deposit of borate of lime, occurring in the interior of Peru. Great pains are taken to crystallize the solution in regular crystals of a large size, as such only are marketable.

BORER, *bor'-er*, a name given to many very small coleopterous insects of the genus *Ptinus*. Their name is derived from the fact that their larvæ, small white maggots, eat their way into old wood, &c., by means of strong cutting jaws, called *maxillæ*. These holes, which they are constantly making in old furniture, have all the appearance of having been produced by a fine gimlet or drill. After working its way into the wood, the borer fills up the drill-hole in its passage with a fine powder, and forms a cocoon, from which it afterwards emerges in the form of a small winged beetle. The *Anobium tesselatum*, one of the same genus, is remarkable for a loud ticking noise which it makes at night, and which has gained for it the title of the Death-watch. The *Anobium striatum* is also remarkable for the persistent way in which it simulates death.

BORON, *bor'-on*, a combustible element, closely allied in its properties to carbon and silicon. In nature it occurs in combination with oxygen, in the form of boracic acid, in a few localities. It was first obtained by Davy in 1808, by submitting moistened boracic acid, inclosed between platinum plates, to the action of the voltaic current. A brownish substance appeared at the negative pole, which, conceiving to be a metal, he termed *boracium*. By further experi ment he proved it to be a non-metallic body, resembling carbon in its properties, and altered its name to *boron*. It was, however, but imperfectly known until Thenard and Gay-Lussac obtained it more readily by heating boracic acid with potassium. The metal combined with the oxygen of the acid to form potash, which was washed away with water, leaving the boron behind. More recently MM. Deville and Wöhler have obtained it in garnet-red transparent crystals, by fusing boracic acid with 80 per cent. of metallic aluminium in a powerful furnace. The crystals are extremely hard, scratching sapphire and corundum, and yielding only to the diamond, which is generally injured by the operation. Crystallized boron has never been fused, and resists the action of oxygen at very high temperatures. Boron is obtained in a graphitic form when borofluoride of potassium is decomposed by aluminium. It bears a close relation to the graphitic form of carbon, or ordinary graphite. Boron combines with several elements, forming borides with the metals. The close relation always supposed to exist between boron and carbon has been curiously confirmed by the fact of both of these elements being capable of assuming the amorphous, crystalline, and graphitic forms. The only important compound of boron is boracic acid.

BOS. (*See* BOVIDÆ.)

BOSWELLIA, *bos-wel'-li-a*, a genus of plants belonging to the natural order *Amyridaceæ*. The most important species is *B. thurifera*, or *serrata*, a tree which grows to a large size, in hilly situations, from the Coromandel coast to the central parts of India. This plant is the source of the valuable gum-resin known as Indian olibanum, and generally believed to have been the frankincense of the ancients. (*See* OLIBANUM.) *B. papyrifera*, a native of Abyssinia, also yields a fragrant gum-resin, and is further remarkable on account of its inner bark, which peels off in thin white layers like paper.

BOTANY, *bot'-a-ne* (Gr., *botane*, an herb), that part of natural history which relates to the vegetable kingdom. In its widest sense, botany comprehends all that is known of plants, and, therefore, forms a boundless field of inquiry. The student has to consider the external configuration of plants—their structure, the functions which they perform, the relations which they bear to each other, and the uses to which they are subservient. The practical bearings of botany are most important. All the principal plants affording food, timber, medicine, fibres, dye-stuffs, and other useful products, are noticed in this work under the names of the genera which include them. Many arts and sciences closely connected with botany are explained in separate articles. (*See* MATERIA MEDICA, AGRICULTURE, HORTICULTURE, ARBORICULTURE, GARDENING, PHYSICAL GEO-

GRAPHY.) Two primary divisions of the whole subject are adopted as facilitating the study of the science:—I. STRUCTURAL, or BIOLOGICAL BOTANY, which includes the investigation of the organic structure, life-growth, action and propagation of plants. II. SYSTEMATIC BOTANY, relating to plants as consisting of various kinds, enumerated and classified.

I. *Structural Botany.*—That branch of structural botany which has reference to the elementary tissues is sometimes distinguished as *Vegetable Histology.* The microscope has shown that the various tissues are composed of little membranous sacs or vesicles, varying in form and size, and united in different ways. (*See* CELL.) Some plants consist of single cells only, which continue throughout life to produce new cells, and to perform all the vital functions. A flowering plant, however, although originally cellular, produces organs composed of cells and vessels, variously modified and arranged, and covered by an epidermis. These compound organs may be divided into *nutritive*, or those concerned in the nourishment of the plant, and *reproductive*, or those which are employed in the production of new individuals. The former are the *stem*, *root*, and *leaf;* the latter, the *flowers* and *fruit.* Leaves occupy various positions on the stem and branches, and their arrangement forms a subject for special study. (*See* PHYLLOTAXIS.) The arrangement of flowers on the floral axis and its ramifications, has also to be considered. (*See* INFLORESCENCE.) The term *Morphology* has been applied to that part of structural botany which treats of the transmutation of leaves into other forms and their resulting adaptations to new uses. The researches which have been made in this department, have confirmed the doctrine first advanced by the German poet Goethe, that all those parts familiarly known as leaves, flowers, and fruit, are constructed on a simple uniform plan, out of one kind of organ in different states of modification and combination. *Biological*, or *Physiological Botany* treats of plants in a living or active state, and of the manner in which their functions are performed; it explains how they are influenced by the several agencies of light, heat, air, and moisture; and it describes their various secretions and the nutriment afforded by the soil. Plants, not being endowed with voluntary motion, derive their food either from the soil in which they are fixed, or from the atmosphere by which they are surrounded. The nutriment, consisting of water, generally holding salts in solution, is absorbed, by the aid of endosmose, by the extremities of the roots. It then passes from cell to cell, and ascends the stem, dissolving, in its course, some of the organic matter stored up in the vegetable tissue. Arrived at the green shoots and surfaces of the leaves, which are covered with minute openings, or *stomata*, the sap is exposed to the influence of light, heat, and air. About two-thirds of the moisture taken up is now evaporated and exhaled; the remainder, which, of course, becomes thickened, undergoes certain chemical changes, and then begins to descend by the under-surface of the leaf, and along the bark. It takes either a direct or a circuitous course downwards, communicating with the centre of the stem by the medullary rays, depositing various secretions, more especially in the bark, and giving origin to substances which are destined to nourish and form new tissues. Finally it reaches the extremity of the root, where absorption had commenced: a small portion is there excreted, while the remainder mixes with the newly-absorbed fluids, and again circulates in the sap. (*See* ENDOSMOSE, SAP, SECRETIONS.) The circulation of the sap has been adduced as an example of the vital processes elucidated by physiology, because it is due to the combined action of all the organs of nutrition, and may therefore serve instead of several illustrations. The study of the special functions of the various organs necessarily precedes that of the general physiological phenomena, such as circulation, assimilation, respiration, fertilization, and germination. Under the names of the different organs of nutrition and reproduction, the reader of this work will find full particulars respecting their functions. The physiology of reproduction is treated of at length under the heads POLLEN and EMBRYO.

II. *Systematic Botany.*—This department of the science is sometimes named Taxological Botany (Gr., *taxis*, and *logos*, a discourse), or, less accurately, Taxology or Taxonomy. It includes the principles of classification, which are based on the observations which have been made on the structure and physiology of plants; and the study of it should be preceded by a study of structural botany. The object of systematic botany is to name, describe, and arrange plants in such a manner that the botanist may readily ascertain the name of any specimen, and, at the same time, get an insight into its true nature and general properties. When it is considered that there are some 120,000 known species of plants, it is obvious that there must be a definite nomenclature and classification, were it only to facilitate reference and communication. Before plants can be classified, their peculiarities of structure must be clearly defined: hence the necessity of the technical language which is employed in descriptive botany. Botanists are blamed for using so many hard words (Hood humorously remarked that if gardeners really loved the flowers they would not call them such hard names), but it should be remembered that they have to explain very minute points of structure, and must employ a language more rigorously defined than that of ordinary conversation. That part of systematic botany which relates to the technical language of the science is sometimes called *Glossology.* The principles of classification constitute what is properly called *taxological botany*, though this term is often applied to the whole department. There have been two great plans proposed for the classification of plants, one denominated *artificial*, and the other *natural.* The first is founded on characters taken from certain parts of plants only, without reference to others; while the second takes into account all the parts of plants, and involves the idea of *affinity* in essential organs. In both artificial and natural systems, the lower divisions—namely, the genera and species—are the same, the great difference between them consisting in the manner in which the genera are grouped into orders, and the orders into classes. (*See* SPECIES, GENUS, ORDER, CLASS.) The plants in one of the higher divisions of an artificial system, such as that of Linnæus, have no necessary affinity, and are connected only by certain characters, more or less superficial, which have been selected as the signs of that division. Such a system may therefore be compared to a dictionary, in which words are arranged for convenience of reference, in alphabetical order, adjacent words not necessarily agreeing with each other, further than in commencing with the same letter. In a natural order, on the contrary, all the genera will be found to have a true family likeness; for their association is the result of a careful consideration of the structure of every organ. The classes in the natural system have been formed upon the same principle, by uniting orders which possess many important characters in common. The natural system of classification is based upon the real affinities of plants, and necessarily takes into account all the organs. Though it cannot be perfect until all the plants of the globe have been examined, it has already reached a very high point of development, and a great number of the orders which have been determined are quite as natural as the orders in the animal kingdom. A knowledge of one species is to a great extent the knowledge of many; for an individual, if well selected, will exhibit the most important characters of all the other plants in the same natural group. Thus, by studying the common radish (*see* RAPHANUS), or the mustard (*see* SINAPIS), the botanist may obtain a general knowledge of about 1,600 species which constitute the order *Cruciferæ*, and which are all formed, as it were, on the same ype. The properties of plants accord in a very remarkable manner with their structure; and, as a general rule, the position of a plant in the natural arrangement indicates its properties. For example, if a botanist, on examining a plant, finds all the structural peculiarities of the order just mentioned, he may feel confident that it is not poisonous, but most likely antiscorbutic or pungent. If, however, he should meet with one of the *Atropaceæ*, he might safely set it down as a plant possessing poisonous narcotic properties. Enough has been said to prove that the natural system is much more than a mere index to the names of plants. It reveals to a certain extent the plan of creation, and is at once an aid to research and a record of discovery. Several schemes based upon the natural affinities of plants have been devised. These may be regarded as so many versions of the one true system; for, though they have been worked out by different methods, they agree in nearly all their grand divisions. The characters by which the primary groups have been determined are furnished by the elementary tissues, and the most important organs of vegetation and reproduction. Regarding only the elementary structure, plants may be arranged under the heads of *Cellular* and *Vascular*, according to the absence or presence of regular vessels. (*See* TISSUE, CELL, VESSEL.) A more satisfactory arrangement results from a consideration of the different modes by which plants are propagated. Some spring from true *seeds*, containing the rudimentary organs called cotyledons; while others are developed from *spores*, in which no distinct organs can be traced. The former are said to be *cotyledonous*, and the latter *acotyledonous* (without cotyledons). As the number of cotyledons forms a natural distinctive character, the first group of plants is subdivided into *monocotyledonous*, having one cotyledon, and *dicotyledonous*, having two cotyledons. The mode in which the root is produced affords characters which confirm this arrangement. The young root of an acotyledon is *heterorhizal*, that of a monocotyledon is *endorhizal*, and that of a dicotyledon *exorhizal*. (*See* EMBRYO.) The three groups are further characterized by the stems; those of the first being *acrogenous*, those of the second *endogenous*, and those of the third *exogenous*. (*See* STEM.) Stemless plants are said to be *thallogenous*, and form a distinct section of the acotyledonous group. The venation of the leaves establishes the same great natural divisions; and similar results are obtained from a consideration of the flowers; monocotyledons and dicotyledons being flowering, and acotyledons flowerless The arrangement adhered to in this work is that adopted by Professor Bentley in his excellent "Manual of Botany." It is founded upon the schemes of Jussieu, De Candolle, and Lindley.

Divisions of the Vegetable Kingdom.—The vegetable kingdom is divided into two sub-kingdoms—Phanero gamia, flowering or cotyledonous plants; and Crypto gamia, flowerless, or acotyledonous plants.

PHANEROGAMIA.—Plants which have evident flowers and which are propagated by seeds containing coty ledons.

Class I.—*Dicotyledones.*—In this class there are two great divisions:—Division 1. *Angiospermia.*—Ovules inclosed in an ovary, and fertilized indirectly by the action of the pollen on the stigma. In this division there are four sub-classes:—1. *Thalamifloræ*, or plants with flowers usually furnished with both calyx and corolla, the latter composed of distinct petals inserted on the thalamus; stamens hypogynous, or adherent to the sides of the ovary. 2. *Calycifloræ*, with flowers having usually calyx and corolla, the latter mostly with distinct petals and inserted on the calyx; stamens either perygynous or epigynous. This sub-class is divided into—1. *Perigynæ*, in which the calyx is free, or nearly so; the stamens usually perigenous, and the ovary superior. 2. *Epygenæ*, in which the calyx is more or less adherent, and the ovary inferior. 3. *Corollifloræ*, flowers having both calyx and corolla, the latter with united petals; stamens inserted on the corolla or ovary, or free and arising from the thalamus. Sub-divisions:—1. *Epigynæ*, in which the calyx is adherent, and the ovary consequently inferior. 2. *Hypostaminæ*, in which the stamens are inserted into the thalamus, and do not adhere to the corolla; ovary superior. 3. *Epipetalæ*, or *Epicorollæ*, in which the corolla arises from the thalamus, and has the stamens attached to it; ovary superior. 4.—*Monochlamydeæ* or *Apetalæ*, flowers having either a calyx only, or without both calyx and corolla. Division 2. *Gymnospermia*—Ovules naked, or not inclosed in an ovary, being fertilized directly by the action of the pollen.

Class II.—*Monocotyledones.* In this class there are three sub-classes:—1. *Dictyogenæ*—Leaves with a reticulated venation, deciduous; rhizome and root with the wood arranged in a concentric manner; floral envelopes verticillate. 2. *Petaloidæ* or *Floridæ*—Leaves with a parallel venation, permanent; floral envelopes (perianth) verticillate, and usually coloured, rarely scaly, sometimes absent. Sub-divisions:—1. *Epigynæ*, in which the flowers are usually hermaphrodite; perianth adherent; ovary inferior. 2. *Hypogynæ*, with flowers usually hermaphrodite; perianth free; ovary superior. 3. *Diclines*, in which the flowers are usually unisexual; perianth, either absent or consisting of a few scales. 4. *Glumaceæ*—Leaves parallel-veined, permanent; flowers glumaceous, that is, having no proper perianth, but consisting of imbricated bracts.

CRYPTOGAMIA.—Plants which have no flowers, and which are propagated by spores. This sub-kingdom constitutes a class by itself—viz., Class III.—*Acotyledones.* Other characters besides those which define the sub-kingdom may be enumerated. The germination is indefinite or obscure; the stem is sometimes present and sometimes absent—in the former case, when woody, it is acrogenous; the leaves, when they exist, have forked veins; no true flowers are produced. There are two sub-classes:—1. *Acrogenæ*—Plants with stems and leaves distinguishable, and possessing stomata. 2. *Thallogenæ*—Plants with no distinct stems or leaves; stomata absent.

Various Systems of Botany.—The Linnæan system leads to little more than a knowledge of names, and can only be looked upon as an index to the genera. Though superior to every artificial scheme previously promulgated, its day has gone by, and the more philosophical system has taken its place. Linnæus himself never intended it to be anything more than a provisional arrangement, and distinctly stated that a natural method was the great object of scientific inquiry. The general principles of the Linnæan, or Sexual system, may be explained in a few words. Twenty-four classes are founded on the number, position, relative lengths and connection of the stamens; while the orders in these classes depend on the number of styles, the nature of the fruit, the number of the stamens in the classes where this character is not used used for distinguishing them, and the perfection of the flowers. The twenty-fourth class includes plants having inconspicuous flowers, and in it the orders are formed according to natural affinities. Under these classes and orders, all the known genera and species are arranged. Even as an artificial method for discovering the names of plants, the Linnæan system has many imperfections. Being based upon the more obvious characters of the reproductive organs, it cannot be of the least use when the plants are not in full flower, with all the stamens and styles perfect. The different flowers on the same plant often vary as regards the number of the stamens. Again, if the classification were carried out rigidly, it would separate, in many instances, the species of the same genus; but so sensible was Linnæus of the importance of maintaining the natural character of his genera, that he sacrificed the symmetry of his scheme for the sake of keeping all the species together. The scheme devised by Professor Lindley is more symmetrical, and in many respects more philosophical, than any other; but the names given to the different groups have not been as yet generally adopted by botanical writers. The seven classes of this beautiful arrangement are distinguised by the following characters:—1. *Thallogens*—A sexual or flowerless plants, without proper stems or leaves. 2. *Acrogens*—A sexual or flowerless plants, with stems and leaves. 3, *Rhizogens*—Sexual or flowering plants, with acotyledonous embryos and fructification springing from a thallus. 4. *Endogens*—Monocotyledonous flowering plants, with endogenous stems, parallel venation, and ternary symmetry. 5. *Dictyogens*—Monocotyledonous plants, with reticulated venation. 6. *Gymnogens*—Polycotyledonous exogens, with naked seeds. 7. *Exogens*—Dicotyledonous plants, with seeds in a seed-vessel. These are arranged in four subclasses. Under the above heads Lindley places all the natural orders, which he arranges in groups termed Alliances.

History of Botanical Investigation.—The earliest work on the subject of which we have any knowledge, is the production of Theophrastus, a pupil of Aristotle. More than 600 plants were described by Dioscorides, who lived in Asia Minor in the first century of the Christian era, and his work was for a long period considered as a great authority; but very inferior to that of Pliny the elder, who described more than 1,000 species. One of the earliest methodical arrangements was that of Cæsalpinus, a Roman physician attached to the court of Pope Sixtus V., in the 16th century; and other students of the subject about the same period were German, the Otto Brunsfels, Bock, Fuchs; Dodœns and De L'Obel, Hollanders; Gesner, a Swiss; Moulins, L'Ecluse, and other French writers. These authorities were ultimately displaced by the attractive scheme of Linnæus, who must be looked upon as the great promulgator of the artificial method of classification. Turner, who lived in the early part of the 17th century, has been styled "the father of English botany," and he was followed by Robert Morison, who became professor of botany at Oxford. The first attempt at arranging plants according to their natural affinities was made by our great countryman John Ray, in the year 1682. His scheme was necessarily very imperfect, for the number of plants then known was comparatively small; still it was in its leading features correct, and has really formed the foundation of every later system. About the middle of the 17th century, the invention of the microscope afforded invaluable aid to the botanist, and investigations were eagerly made by Henshaw, Hook, and Grew, in this country, and by Malpighi, in Italy. About the same time Tournefort, a Frenchman, and Rivinus, a German, achieved great results. Jussieu developed Ray's views of the natural affinities in the vegetable kingdom. Jussieu's method was first made known in the year 1789, just eleven years after the death of Linnæus. Von Haller, a German, almost rivalled Linnæus in eminence. The natural method has been since advanced by the labours of De Candolle, Brown, Endlicher, Lindley, and many others.

Geographical Botany treats of the manner in which plants are affected by climate and station, and endeavours to determine the conditions under which particular families or species of plants are confined to certain zones of latitude and altitude. It is a study of great interest, and one which cannot be successfully prosecuted without an intimate acquaintance with most of the sciences. Of course, so long as there are vast tracts of continents unexplored by botanical travellers, the knowledge upon which this department is founded must be imperfect. (*See* DISTRIBUTION OF PLANTS.)

Palæontological, or Fossil Botany investigates the nature of the plants found in a fossil state in the various geological formations. It is therefore at once a branch of botany and of geology. (*See* PALÆONTOLOGY.)

BOTANY BAY KINO. (*See* EUCALYPTUS.)

BOT-FLY, *bot'-fli* (*Œstridæ*). This name, or that of Gad-fly, is commonly given to insects, which, although most of them are incapable of taking nourishment when in their perfect condition, from the obsolete nature of their mouths, are nevertheless to be regarded as among the greatest pests that afflict cattle. During their larva state (when they are known as *bots*) they are all parasitic upon the various herbivorous animals, some of them harbouring in the skin, and others in the internal cavities of their bodies. In horses these pests are called *bots;* in sheep, *maggots;* and in oxen, *wornibs.* Of the internal parasites, some live in the frontal sinuses of sheep and deer, the parent laying her eggs in the nostrils of the animal, whence the larva creeps up to its destined abode; whilst others (the bots) make their way to the very core of the animal's intestines. The eggs of the latter are laid upon the skin of the horse in such positions as are easily reached with the tongue. This selection of situation, however, is not invariable, nor does it appear to be necessary, to insure the bot's purpose. After the eggs have remained among the hair of the horse's hide four or five days, they arrive so near maturity that the least additional heat is sufficient to hatch them. This additional heat is supplied by the application of the friendly horse's lips and tongue; the larvæ are liberated, and, adhering readily to the moist surface of the horse's mouth, are conveyed straight into his intestines. It is satisfactory to learn that opinion is at least divided as to whether the bot-fly in the horse's stomach is hurtful. The horse has an instinctive horror of this insect, and, as soon as it flies near him, he gallops round the field or inclosure until he is in a profuse perspiration, and then comes to a sudden stop, in a state of tremor. The fly makes a most delicate poise on the wing, and then suddenly darts at the horse and deposits an egg. This is repeated until several hundreds are affixed to the hairs, generally of the leg. When the larvæ become perfect, they pass from the body of the animal with the dung, in which they remain until they are matured into a fly. They frequently attach themselves, by a hook-like process, near the anus of horned cattle, and drop with the dung. The ox-bot (*Hypoderma bovis*) is more troublesome than any species of the insect which attacks the horse. Each species is about half an inch long. The sheep-bot (*Cephalemgia ovis*) is somewhat smaller, is a greater pest even than the others. The eggs are deposited in the nostrils of the sheep, and, when hatched, drive the sheep almost mad. Goats, deer, and other quadrupeds are subject to the attacks of the bot-fly. In the summer months oxen frequently stand in a pond or pool for a considerable time, their instinct leading them to this course in order that they may effectually get rid of their future enemy.

BOTHRODENDRON, *both'-ro-den'-dron* (Gr., *bothros*, pit, *dendron*, tree), fossil stems, with dotted surfaces, occurring in the coal-measures, and distinguished from *Sigillaria* and *Stigmaria* by two opposite rows of deep oval pits, which appear to be the scars left by large cones or seed-bracts.

BOTHRIOCEPHALUS, *both-rio-sef'-a-lus* (Gr., *bothrion*, a small cavity, and *cephale*, a head), a genus of intestinal worms, belonging to the order Cestode Worms. It differs from the true tapeworm, in having two longtitudinal hollows, which serve for the purpose of adhesion, in place of the four sucking disks of the tapeworm. These worms are very abundant in some kinds of fish, and in fish-eating birds. It very frequently appears in the stickleback, but remains undeveloped until the fish is eaten by a bird, when it acquires its mature form and remains in the bird's intestines. It exudes an oleaginous matter, which is probably the cause of the injurious effects produced on the animals infested by the worm. Only one species, *B. latus*, is found in human beings, and is sometimes known as the Broad Tapeworm. Each of the segments contain organs of reproduction. It sometimes attains a length of fifteen feet, and sometimes several of them will be expelled by one patient. It is very rare in this country, but more frequent in marshy districts of the Continent.

BOTRYCHIUM, *bo-trik'-i-um* (Gr., *botrus*, a bunch of grapes), a genus of ferns of the division *Ophioglosseæ*. The only British species is *B. lunaria*, commonly called Moonwort, a little fern common on mountain pastures. *B. Virginicum* is found in many parts of America, Asia, and Africa; but in Europe it is strangely confined to Norway. Its fronds, which are large and succulent, are boiled and eaten in the Himalaya, New Zealand, and a few other parts. It is, in America, frequently known as the Rattlesnake fern, being found in places where rattlesnakes abound.

BOTRYOIDAL, *bot'-ri-oi-dal*, a term applied to masses occurring in a concretionary form resembling bunches of grapes. Certain limestones and hæmatites are found in this form.

BOTRYOLITE, *bot'-ri-o-lite*, datholite, or boro-silicate of lime, occurring in a *botryoidal* form at Arendahl, in Norway. It is also found near Lake Superior in such large quantities, that it has been used as a flux for copper, and as a source of boracic acid.

BOTRYTIS, *bot'-ri-tis*, a genus of fungi, comprising many of those microscopic plants which, in their fully-developed condition, form the different kinds of mould found on bread, cheese, preserves, fruits, paper, and other substances. Many of the species are peculiarly destructive to living animals and plants: thus the disease in the silkworm known by the name of *muscardine*, is produced by one or more; a disease to which turnips are particularly liable is connected with the growth of the species *B. parasitica;* and the much-dreaded potato disease is confidently ascribed by many observers to *B. infestans*. (*See* POTATO DISEASE.)

BOTTLE-FISH (*Saccopharynx ampullaceus*), a very singular fish, belonging to the genus *Saccopharynx*. Very few specimens of the genus have been taken, and, with the exception of size, they realize many of the fabulous accounts of the sea-serpent. The length is from four to six feet. The most singular fact connected with the bottle-fish is, that its body is capable of being inflated like a leathern bottle, and it has a long slender tail like a whiplash. It has a pointed snout, and its mouth is furnished with long sharp teeth. Under the small pectorals the three branchials can be seen through the irregularly-shaped gill-openings; and the extensibility of the jaws is greater than that of the serpent tribe. It has a slightly granular, but soft, loose, and slimy skin, and is very voracious; one of the examples found was discovered to have swallowed a fish longer than its own body, and the other a sea-perch thicker than itself.

BOTTLE-GOURD, *goord*, a genus of plants known as *Lagenaria* (from Lat., *lagena*, a bottle), belonging to the natural order *Cucurbitaceæ*, and nearly allied to the true gourd, but differing from it in having white flowers and the disposition of the seeds. The common bottle-gourd, sometimes known as the False Calabash, is a native of India, but is now cultivated in warm climates in other parts of the world. It is a climbing, musky-scented annual, with clustering flowers, and the fruit, varying from one foot to five, or even six feet in length, is shaped like a bottle. The rind, when dried, is used for holding water (*see* BOTTLE), and is generally known as a Calabash. In the wild state this plant is bitter and poisonous, and when cultivated has generally strong purgative properties. Some varieties, however, have an edible pulp of refreshing qualities. In warm countries, especially Arabia, it is cooked with vinegar, or boiled with rice and meat.

BOTTLE-HEAD, known also as the Bottle-nosed or Bottle-headed Whale, and the Beaked Whale, a cetaceous animal, generally described as belonging to the Dolphin family, but appearing to be a connecting link between them and the whale. The average length is about 25 feet; the skin is smooth and glossy, black on the back, yellow on the sides, and nearly white on the belly. The snout is lengthened into a beak-form, and the forehead rises suddenly from the beak, and is unusually elevated, owing to the large bony crests above the upper jaw. The animal is very rarely met with in European waters, but occasionally enters harbours or the mouths of rivers; and about 1786 one was captured in the Thames, above London Bridge, and its skeleton may be seen in the Museum of the Royal College of Surgeons, Lincoln's Inn Field.

Bottle-Nosed Whale. The name is also sometimes given to a species of dolphin, *Delphinus Tursio*, occasionally found in British waters.

BOTTOM-BEDS, in Geology, the name sometimes given to some partially or doubtfully fossiliferous strata which immediately underlie the Silurian system in Wales.

BOULDER CLAY. (*See* DRIFT.)

BOULDERS, *bole'-ders* (Sax.), in Geology, any rounded or waterworn blocks of stone too large to be included under the heads of "pebbles" and "gravel." The term *erratic boulders* is generally applied to the detached masses of rock which are found lying upon the surface, and which have been washed out of the clays of the Glacial epoch, or brought separately from their original sites by icebergs. They are often found resting on hill-tops, which during the Glacial period were banks and shallows in the sea, and so arrested the laden icebergs in their course. The largest boulder known in the British islands is near the head of the Devil's Glen in county Wicklow. It is 27 feet long by 18 wide, and 15 high. It is of granite, resting on Cambrian grits and slates, six or eight miles from the nearest granite *in situ*, with a wide shallow valley between the hill on which it now stands and the granite district. Very large erratic blocks of Scandinavian rocks are scattered over the plains of Denmark, Prussia, and northern Germany. The monolithic pedestal of the statue of Peter the Great at St. Petersburg was hewn out of a boulder weighing 1,500 tons, that lay on a plain not far from the city. (*See* DRIFT, GLACIER, PLEISTOCENE.)

BOULIMUS, *boo'-li-mus* (Gr., *bou*, great, and *limos*, hunger), is a word used in medicine to denote a morbidly voracious appetite.

BOUQUETIN, *boo'-ke-tang*, or Ibex of the Alps, (*Capra Ibex*) a species of goat, now almost extinct, inhabiting the higher regions of the Alps; between Valais and Piedmont, it is larger and more powerful than the ordinary goat, having a small head and great horns. It feeds on shrubs, lichens, and the scanty herbage growing on high mountains. The horns of the male are some times 20 inches long, and curve backwards, the horns of the female are only about 6 inches. It has no beard, only a few hairs in winter. Formerly it was found on all the Alpine mountains and is regarded as the true ibex of the ancients. When taken young, it can easily be tamed and will breed well with the common goat. It has a most extraordinary power of leaping great heights and distances, and also of ascending or descending steep precipices. It is often found at greater heights even than the chamois. Among the inhabitants of German Switzerland, it is known as the *Steinbock*. (*See* IBEX and STEINBOCK.)

BOURBON TEA, *boor'-bawhn*. (*See* ANGRÆCUM.)

BOURNONITE, *boor'-no-nite*, a mineral found at Endellion, in Cornwall, in steel-grey tabular crystals, or massive granular aggregations. It is a mixed sulphide of antimony (26 per cent.), copper (12·8 per cent.), and lead (41·8 per cent.); sulphur (19·4 per cent.). It is often found in masses resembling a cogged wheel, and is thence called *wheel-ore*. It is also known as *Endellionite*.

BOUVARDIA, *bov-var'-di-a*. (*See* CINCHONACEÆ.)

BOVEY COAL, a species of lignite or wood-coal found at Bovey in Devonshire, from which place it takes its name.

BOVIDÆ, *bo'-vi-de* (Lat., *bos*, *bovis*, an ox), the hollow-horned ruminating animals belonging to the class *Mammalia*, order *Ruminantia*. The species belonging to this family are hoofed, and their stomachs are adapted for chewing the cud. Their frontal bones are usually provided with hollow horns. They have also twelve grinders or molar teeth on each jaw. In this family are included—*Bovina*, the oxen; *Giraffina*, the giraffes; *Cervina*, the deer; *Moschina*, the musk-deer; and *Camelina*, the camels. The exact number of species has not yet been accurately ascertained. (*See* also ARNEE, BANTERING, BISON, BUFFALO, URUS, YAK, &c.)

BOWDICHIA, *bo-dik'-i-a*, a genus of plants belonging to the natural order *Leguminosæ*, sub order *Papilionaceæ*. The only species requiring notice is *B. virgilioides*, the bark of which, with that of one or more species of *Byrsonima*, forms the American alcornoco bark of commerce. (*See* BYRSONIMA.)

BOWERBANKIA, a genus of Zoophytes, of the class *Polyzoa*, order *Infundibulata*, growing on seaweeds, stones, and corallines, and forming branching tufts sometimes nearly two inches in height. One species, B. *imbricata*, is very abundant on the British coasts. The branches are filled with cells, in each of which is a polype, connected with the common life of the polypidon. Each polype has ten finely cilicated tentacula, which, being kept in active motion, bring animalculæ or organic particles into the mouth.

BOWER-BIRD, *bauw'er-bird*, an Australian bird, belonging to the *Sturnidæ* or Starling family, remarkable for making extraordinary bower-like structures of sticks and twigs so interwoven that the tops turn in and form a covering. These bowers are decorated with all kinds of brilliant and striking objects, such as gaudy-coloured rags, parrot feathers, shells, bleached bones, &c. Like the magpie of the British isles, the bower-bird will often take away spoons and cups, so that if the natives or settlers lose any of their scanty possessions it is quite probable they may be found in the bowers of the bower-bird. Mr. Gould, in his "Birds of Australia" says that these bowers are not used as nests, but probably as assembly rooms, where the bower-birds of both sexes sport in the most playful manner; they are probably also used as places of rendezvous during pairing time, and for the elegancies and amusements, rather than the necessities, of bird life. The *satin bower-bird* is about the size of a jackdaw or small crow. In the adult male the plumage is a deep satiny blue-black. This species is the *cowry* of the natives. There are other species—the green satin bower-bird, spotted bower-bird, and the great bower-bird. The latter is about 15 inches long, and is found in North-Western Australia, and makes highly ornamented bowers, which are always adorned with sea-shells.

BOW-STRING HEMP, a silky, white and elastic fibre used to make bow-strings, produced from the large leaves of the *Sanseviera Feylanica*, a plant found in the East Indies. The Hindoo name is *moorva*. It does not rot in water so quickly as hemp. A species of the *Sanseviera* is found on the west coast of Africa, from which fine fibre, called African bow-string hemp, has been obtained.

BOX, a genus of evergreens, shrubs, or small trees. (*See* BUXUS.)

BOX TORTOISE, OR LOCK TORTOISE, popular names of a species of tortoise found in America, and characterized by a cross-wise division of the plastron which enables the animal to shut himself up entirely in his shell. Box tortoises are very timid and gentle; their legs are larger and their speed greater than the ordinary tortoise.

BOX THORN (*Lycium*), a genus of plants not known in England, of the natural order *solanaceæ*, having numerous species found in all quarters of the world. Some grow to the height of 30 or 40 feet.

BOYLE'S LAW, ALSO CALLED MARRIOTTI'S LAW, is the law that the volume of a gas is inversely as the pressure—*i.e.*, if we double the pressure upon a gas its bulk is reduced half the size, if we triple the pressure its bulk becomes one-third the size.

BRACHIAL ARTERY, *brak'-i-al*, the downward extension of the axillary artery, or, in other words, the principal artery between the armpit and the elbow. It is situated in the inner side of the arm along the inner edge of the biceps muscle, and behind the great median nerve; in cases of bleeding from the arm, it may be pressed against the bone. It gives out four smaller branches; first, the superior profunda; second, a small artery to supply the medullary membrane of the arm bone; third, the inferior profunda; and fourth, the anastomotica magna, which is again divided into numerous branches around the elbow. Below the bend of the arm it divides into two branches, the cubitalis and radialis.

Brachial Muscle, or *brachialis internus*, is situated on the fore part of the os humeri. It rises fleshy from the middle of the os humeri at each side of the insertion of the deltoid muscle, covering the inferior and forepart of this bone, and is inserted by a strong short tendon into the cornoid process of the ulna. Its use is to bend the fore-arm.

BRACHINUS. (*See* BOMBARDIER BEETLE.)

BRACHIOPODA, *bra-ki-op'-o-da* (Gr., *brachion*, an arm, *pous*, a foot).—A term applied to certain molluscous animals having bivalve shells. They derive their name from the remarkable organs by which they procure their food. From the sides of the mouth project two long arms, disposed wholly or partly in spiral curves when not used for seizing the prey. These organs are not only used for obtaining food, but also in maintaining the necessary current for respiration. They are usually furnished with a number of vibratory filaments. The *Brachiopoda* or *Palliobranchiata*, differ from the great majority of recent molluscs with bivalve shells, both internally and externally. The species now existing are very widely diffused, and are all marine; one of them, the *Crania personata*, has been brought up from a depth of 500 yards. The *terebratulæ*, or Lamp shells, are most numerous.

BRACHIUM, *brai'-ki-um* (Gr., *brachion*, the arm), the name given to the arm, or that part of the upper extremity which extends from the shoulder to the wrist.

BRACHYPTERÆ, OR BRACHYPTERES, (from the Greek signifying short-winged), web-footed birds with short wings, as auks, ducks, grebes, puffins, penguins, &c. They are all aquatic in their habits.

BRACHYSTOCHRONE, *brai'-kis-to-krone* (Gr., *brachus*, short; *stoicheion*, a line), a term employed to designate the curve described most rapidly, between two points in its course, by a falling body. The term was first used by John Bernouilli, professor of mathematics at Groningen, in 1696, who first drew the attention of philosophers to it. The curve is commonly called "the line of swiftest descent."

BRACKLESHAM BEDS, *brak'-el-sham*, the lower tertiary sands and clays immediately overlying the London clay, so called from being well exposed at Bracklesham Bay, near Chichester. These beds are included in the Bagshot series.

BRACT, BRACTEA, OR FLORAL LEAF, *brakt* (Gr., *bracho*, I crepitate), a modified leaf from the axil of which a flower-bud, instead of an ordinary leaf-bud, arises. Strictly speaking, the term bract should only be applied to the leaf from which the primary floral axis, whether simple or branched, springs; while the leaves which are produced on the axis between the bract and the outer envelope of the flower should be distinguished as *bractlets* or *bracteoles*. In ordinary descriptions, however, the term bract is used to indicate either kind of floral leaf. Bracts are sometimes large, and similar to the ordinary leaves of the plants upon which they are placed, as in the white dead-nettle. Such bracts are termed *leafy*, and can only be distinguished from the true leaves by their position with regard to the flower-stalk or flower. In general, however, bracts differ greatly from ordinary leaves. Though the bract is generally a small and inconspicuous organ, it occasionally acquires a considerable size, and may actually surround all the flowers of a plant so as to completely inclose them when in a young state. A sheathing bract of this description is called a *spathe*; it is very remarkable in the common arum. From the word bract several adjectives are formed; namely, *bractiscent*, assuming the appearance of a bract; *bractical*, furnished with bracts; *bractiolate*, having little bracts.

BRADFORD CLAY, *brad'-ford*, a blue unctuous clay occuring at Bradford, near Bath, and extending for a few miles around that town. It is a member of the Oolitic system; nowhere more than sixty feet in thickness, and is full of the fossils called *Apiocrinites*. The clay rests on calcareous rock, and is supposed once to have been a sea or lake in which these animals lived. When, however, the once clear water became charged with mud, and gradually or suddenly filled up, their bodies became dismembered and distributed through the clay. The surface of rock consists for the most part of their bases now turned to stone. (*See* FOSSIL and ZOOPHYTE.)

BRAHMIN BULL (*Bos indicus*). (*See* ZEBU.)

BRADYPUS. (*See* SLOTH.)

BRAIN, *brain*, is the name given to a soft pulpy substance, which in man and the higher orders of animals constitutes one of the great central masses of the nervous system (which *see*). It is the upper end of the cerebro-spinal tube, and expands into three primary cerebral vesicles, named anterior, middle, and posterior. As might be expected, it is found most perfectly developed in man, in whom, with its membranes, vessels, and nerves, it constitutes the whole of the matter enclosed within the bones of the skull, and is, hence, termed the *encephalon*. The brain is divided by anatomists into the cerebrum, or brain proper; the cerebellum, or little brain; the pons Varolii, and the medulla oblongata. The *cerebrum* occupies the whole of the superior portion of the cavity of the cranium, or skull, and is by much the largest portion of the brain. The *cerebellum* occupies the lower and back part of the cranium, and is next in size to the cerebrum. The *pons Varolii* and *medulla oblongata* occupy the base of the brain. The former occupies a central position on the under surface of the brain, and is connected with the cerebrum by two cords or peduncles, termed *crura cerebri*, with the cerebellum with two similar cords, termed *crura cerebelli*, and is also in contact with the medulla oblongata. This last is that portion of the encephalon which connects it with the spinal cord. It is of a pyramidal form, having its broad extremity turned upwards, and connected with the pons Varolii, while its under portion is united with the spinal cord. The brain is covered by three membranes, two of which, the outer and inner, are termed *matres* (mothers) from the old notion that they gave rise to the other membranes of the body. The outermost of these membranes, from being of a firmer texture than the others, is termed the *dura* (hard) *mater*, and incloses the brain with its appendages, lining also the whole internal surface of the cranium. Its outer surface, which adheres to the bones of the cranium, as the periosteum does to the other bones, appears to be rather rough and irregular; but the inner surface is smooth and shining, and is lubricated by a fluid which is secreted by it. This membrane is the densest and strongest of the whole body, its component fibres interlacing each other in all directions. It sends off several folds or processes, which descend between certain portions of the brain. The second, or middle, of the three membranes, is an extremely thin and delicate substance, and from its fancied resemblance to a spider's web, it receives the name of *arachnoid*. It is transparent and colourless, and is spread uniformly over the surface of the brain. The third investing membrane, the *pia* (soft) *mater*, is also very delicate and tender, but differs from the arachnoid in its abounding in blood-vessels, whereas no blood-vessels have yet been discovered in the latter. The blood-vessels with which every part of this delicate membrane is covered are the nutrient arteries of the brain. They subdivide and ramify to an extreme degree upon the surface of this membrane, so that the blood may enter the substance of the brain only in very minute quantities. As the pia mater contains and supports the nutrient vessels of the brain, it is not only, like the others, spread over its entire surface, but it also penetrates between all its convolutions, and lines every cavity which it contains. The nervous matter of the brain is composed of two distinct substances, differing from each other both in colour and consistence. One of these is the *grey* or *cineritious substance*, termed also, where it forms the outer covering, as in the cerebrum and cerebellum, the *cortical* substance, from its surrounding the inner part like the bark of a tree. The cineritious substance is of a softer consistence than the other, and is composed almost entirely of blood-vessels, connected and sustained by exceedingly fine cellular membrane. It forms an outer covering to the entire surface of the cerebrum of generally about one-tenth of an inch in thickness. The *white* or *medullary substance*, which constitutes the internal portion of the cerebrum and cerebellum, is of firmer consistence, and is composed of microscopic fibres arranged into laminæ and bundles, between which intervening vessels ramify. In the cerebrum these fibres run, in general, in such a direction as to converge towards the base of the brain. The *cerebrum* is of an ovoid shape, but irregularly flattened on its under side. It is divided into two lateral halves, termed hemispheres, separated from each other through a great portion of their extent by the great longitudinal fissure, into which is inserted the *falx cerebri*. This fissure, both before and behind, passes quite through to the base of the cerebrum; but in the middle it is interrupted by a transverse portion of white substance termed the *corpus callosum*, which connects together the two hemispheres. Each hemisphere is subdivided into an anterior, middle, and posterior lobe, but it is only on the under surface of the brain that these lobes are properly marked off. The surface of the cerebral hemi spheres is not plain and uniform, but presents numerous tortuous eminences, named convolutions or *gyri*, which are separated from each other by deep grooves or furrows, termed *sulci*. These are generally about an inch in depth, but they vary considerably in different brains, and even in different parts of the same brain; and, indeed, those of one side frequently differ from those of the other. The convolutions are more marked as the brain is better developed, and are more numerous and manifest in man than in the lower animals. As the cortical substance of the brain is continuous over the whole surface of the hemispheres, in the fissures as well as upon the convolutions, it follows that the greater the number and depth of these, the greater is the superficial extent of the grey matter which is generally regarded as the seat of all the nervous manifestations, as sensation, volition, &c. On slicing away the substance of the hemispheres to a level with the *corpus callosum*, it will be seen to be formed by the converging fibres of the two hemispheres, whence it has been termed the *commissura magna*, or the great commissure of the brain. Under the corpus callosum are the two great cavities termed the *lateral ventricles*, distinguished into right and left. They are very irregular in shape, and are described as each consisting of a body and three horns, or *cornua*—the anterior, posterior, and middle. They are separated from each other by the septum lucidum, which descends from the lower surface of the corpus callosum, and consists of two laminæ, between which is the very small cavity of the septum lucidum. It rests upon the *fornix*, a triangular medullary body, having its apex directed forwards and its base backwards. Posteriorly it is connected with the corpus callosum, and it divides laterally into a posterior cornu on each side, which terminates in, or rather is continuous with, the *tænia hippocampi*, and the *hippocampus major* and *minor*. The third ventricle is a small narrow cavity lying between the *optic thalami*. These last are two large firm oblong bodies nearly an inch and a half long by three-fourths of an inch wide and deep. The *corpora striata* are two grey pear-shaped bodies, but internally they are streaked with white matter—whence their name. In front they are obtuse, and approach each other; but they separate and narrow as they proceed backwards. The *Pineal gland* is a small portion of grey matter about the size of a small pea. It was supposed by Descartes to be the seat of the soul. The *cerebellum*, or little brain, consists of a body and three pairs of crura or peduncles, by which it is connected with the rest of the encephalon; and it is not covered with convolutions like the cerebrum, but appears to be formed of a number of lamellæ, or plates, with sulci between them. The *pons Varolii*, or annular protuberance, is a comparatively small portion of the brain, and occupies a central position on its under surface, above and in front of the medulla oblongata, with which it is continuous. It consists of transverse and longitudinal white fibres, interspersed with a quantity of diffused grey matter. The transverse fibres, with few exceptions, communicate with the cerebellum by means of the middle crura; while the longtitudinal fibres are those which ascend from the medulla oblongata into the crura cerebri. The *medulla oblongata* is that part of the encephalon which is immediately connected with the upper end of the spinal cord, and has an inclination obliquely downwards and backwards towards the foramen magnum. From the under-part of the brain issue a number of nerves, known as the cranial, and pass through foramina in the base of the skull. They are usually reckoned as forming nine pairs. (*See* NERVES.)

Weight and Size of the Brain. In males, the average weight of the full-grown human brain is about 49 or 50 ozs.; in females, 44; but, as the female body is lighter than the male, there is no inferiority in the *relative* size of the brain. It varies, however, considerably in different individuals. Some brains of men have been known to weigh as much as 64 ounces, and of women, 56. Great weight and size do not always go together. Byron had a small head, but his brain was of far more than average weight. In fact, the brain may be compressed into a small compass, or it may be less compact, and therefore occupy greater space, without increasing in value. In fact, sensation and thought depend upon the amount of the grey matter; a small brain may be more active than a larger one; and in this, as in other matters, quantity and quality must be considered together, and temperament (which *see*) must be taken into account as a qualifying element. Anatomists differ as to the size or weight of the brain at different periods of life. In general, the weight of the brain increases rapidly up to the seventh year, then more slowly to between sixteen and twenty, and then more slowly to between thirty-one and forty, at which time it reaches its maximum point. Beyond that period there appears a slow, but progressive, diminution in weight of about 1 ounce during each subsequent decennial period. Generally speaking, as compared to the weight of his body, the brain of man is heavier than that of the lower animals; but there are some slight exceptions to this rule, as in the case of certain species of small birds and in the smaller apes. Huxley says that an average European child of four years old has a brain twice as large as an adult gorilla, whose weight is, perhaps, four times as great. The proportionate weight of the human brain to the body is greatest at birth, being about 1 to 5·85 in the male, and 1 to 6·5 in the female. At the tenth year, it is about 1 to 14; at the twentieth, about 1 to 30; and after that age it averages about 1 to 36·5, with a trifling decrease in advanced life.

Chemical Composition of the Brain. Brain matter (grey and white together) averages in 100 parts.

Water, ...	$75\frac{1}{2}$
Albuminous matter, ...	7
Fat (colourless and red), ...	$11\frac{1}{2}$
Salts (including about $1\frac{1}{2}$ of phosphates),	6

There is most water in the grey, cineritious matter; and most colourless fat in the white matter. It is a noticeable fact that the amount of salts in the healthy brain is about twice that in the brain affected by insanity.

Functions of the Brain. That the brain is the organ of sensation and volition is an established proposition of physiology. In what method the mind acts through it is not so easily determined—anatomists can only arrive at results, metaphysicians can only guess at principles. Some consideration will be given to this subject under the heading MENTAL PHILOSOPHY AND PHRENOLOGY. It is certain that injury to the brain produces abnormal effects; that wasting of the brain is exhibited in imbecility; and that acute disease produces insanity. That temporary inflammation or overstimulation by alcohol induces mental delusions, or loss of power; and that during sleep the mental operations, of which the brain is somehow the medium, are among the most familiar of facts. (*See* IMBECILITY AND INSANITY.)

Brain of the Lower Animals. The only animals that possess absolutely a larger brain than man are the elephant and whale. In the former the brain weighs from 8 pounds to 10 pounds, and in the case of a large whale, about 5 pounds; but we must take into account the proportion of the brain to the size of the body, and the smaller amount of cineritious, or sensitive matter, owing to the comparative absence of convolutions. In the dog the brain bears an average proportion to the body of about 1 to 120; in the horse, 1 to 450; in the sheep, 1 to 750; and in the ox, 1 to 800. The convolutions, too, which are so marked on the human brain, are few, or altogether wanting, on the brains of animals. The nerves of sense, too, in animals are usually much more largely developed than in man. In man the olfactory nerve is not one-fourth the size of that of the horse, though the brain is so much larger. In the smaller quadrupeds the comparative size of the brain approaches nearer to that of the human, being in the mouse about a forty-third part of the weight of the animal; but it is composed almost entirely of medullary matter. In birds, the brain is in general a much less complex organ than in mammals, presenting no convolutions on its surface and having only a very small quantity of cineritious matter. Though its bulk is in general proportionally much smaller than the human brain, yet in some of the smaller birds, as the chaffinch and the redbreast, it approaches, and indeed exceeds, the proportion observed in the human being. In fishes the brain is yet more diminished; in the chub being only 1 to 842, and in the lamprey 1 to 1,425. It consists merely of two pairs of ganglia and a single one. The two anterior ganglia or lobes are the olfactory lobes, immediately behind which are two others, generally of larger size, called the optic lobes; while behind these is a single ganglion, or lobe, situated in the median line, and termed the cerebellum.

Brain, Diseases of the.—Inflammation is one of the most common diseases to which the brain is subject, and may result from a number of causes—from external injuries, as blows or falls, the symptoms of which may not manifest themselves for many days; from the improper use of narcotics or stimulants, exposure to the cold or the action of the sun's rays, protracted study, excessive joy, or other mental emotion; as well as less directly from diseases of the digestive or other organs of the body. It is characterized by more or less violent pain of the head, with suffusion or prominence of the eyes, the countenance generally tumid or flushed, and delirium or stupor. In the treatment of this disease, general and local bleeding are usually had recourse to; the latter by means of leeches applied about the head, or by cupping. The head is also usually shaved, and kept cool by cloths wet with cold or iced water. Frequently, in children, inflammation leads to a form of disease known as water in the head, or hydrocephalus (which *see*). Softening of the brain is caused by the want of a proper supply of nourishment to the cerebral substance, and may arise from various causes. It is characterized by lowness of spirits, headaches, giddiness, the loss of memory, and at length imbecility and paralysis. Unfortunately, this is a disease which little can be done to remedy, especially when it results from a disordered state of the nutrient organs themselves, as from disease or obstruction in the arteries which convey the blood to the cerebral substance. Frequently it is occasioned by over-anxiety or excessive study; in which case everything is to be done to get rid of the predisposing cause. Every thought, every mental effort, destroys a certain portion of the cerebral matter; and hence, if destruction takes place more rapidly than renewal, a wasting or softening of the brain is the result. The blood-vessels, particularly in the aged, are also liable to be ruptured. (*See* APHASIA, APOPLEXY, CONVULSIONS, INSANITY, DELIRIUM TREMENS, PARALYSIS.)

BRAINSTONE CORAL, the common name of certain kinds of Madrepores, or corals of slow growth, formerly included in the Linnæan genus, Madrepora, but now composing the more restricted genus, *Meandrina*. They are found chiefly in the Indian Ocean, but also in the South Atlantic, and some have been seen in the Red Sea. They derive their popular name from their general resemblance to the brain of man. When broken, the coral presents a beautiful appearance, and the markings may be traced inwards through all its substance, even to the central nucleus.

BRAKE, OR BRACKEN, a genus of common ferns, growing luxuriantly on heaths and uncultivated ground in Britain and on the Continent. (*See* PTERI.)

BRAMA *bra'ma*, a genus of fishes, of the family *Chatodontidæ*, of which the body is very deep and compressed, and about two feet in length; tail forked, and with extremely divergent points, and head obtuse; they are most common in the Mediterranean, though occasionally found in British waters. They are sometimes called *Sea-bream* and *gilt head*, though these names are also applied to fishes of other families but of similar characteristics.

BRAMBLE. (*See* RUBUS.)

BRAMBLING, *bramb'-ling* (*Fringilla*), *montifringilla*), also called mountain-finch. This bird is rather larger than the chaffinch, with which it is closely allied. The tail is forked, and its prevailing colour black, white, and yellow. It only visits Britain in winter and breeds in the northern parts of Scandinavia.

BRANCH, *bransh* (Fr., *branche*), that part of a plant which does not rise direct from the root, but originates from a lateral leaf-bud on the primary axis or stem. It is looked upon as part of the stem, and not as a distinct organ. A branch generally produces secondary branches, and these give rise to minor ramifications, called *branchlets* or *twigs*. The different modes in which branches spring from the stem give rise to the various forms of trees; such as pyramidal, spreading, and weeping. The comparative length of the upper and under branches also gives rise to great differences in the contour of trees, as seen in the conical form of the spruce, and in the umbrella-like shape of the Italian pine. (*See* BUD and STEM.)

BRANCHIÆ. (*See* GILLS.)

BRANCHIOPODA, *bran-ki-op'-o-da* (Gr., *branchia*, gills, *pous*, a foot), an order of small crustacea, belonging to the division *Entomostraca*, which usually abound in still fresh waters. These animals have thin mouths, furnished with jaws fitted to masticate their food, and their name is derived from the peculiarity which they possess in having the *branchia* or gills, which are numerous, attached to the feet. Some are popularly known as water fleas and some as brine shrimps. (*See* BRINE SHRIMP.) They swim freely, but their feet are not generally adapted for locomotion. The antennæ, in some cases, serve as organs of motion. While swimming, they keep their feet constantly moving, and thus prevent the water from becoming stagnant.

BRANDLING, *brand'-ling*. (*See* PAR and SALMON.)

BRASH. (*See* RUBBLE.)

BRASSICA, *bras'-si-ka* (from *bresic*, the Celtic name of the cabbage), a genus of plants belonging to the natural order *Cruciferæ*, and containing several species, which are commonly cultivated as food for man and cattle. *B. rapa* is the common turnip. The species *B. campestris* is regarded by some as the source of the Swedish turnip: but others consider this vegetable to be a hybrid between *B. campestris* and *B. rapa*, or *napus*. The species *B. oleracea* is supposed to be the common origin of all the different kinds of cabbage, cauliflower, brocoli, and kohl-rabi, the different varieties having been produced by the art of the gardener. Brocoli and cauliflowers are deformed inflorescences; the kohl-rabi is produced by the stem enlarging above the ground into a fleshy knob, resembling a turnip. On comparing the original plant, as found on our shores, with wavy green leaves, no appearance of head, and flowering like wild mustard or charlock, say with the red cabbage or the cauliflower, the difference is astonishing. *B. napus* yields the rape, cole, or colza seeds, from which a large quantity of bland fixed oil, much used for burning and other purposes, is expressed. The cake left after the expression of the oil constitutes the well-known oil-cake used for feeding cattle. The seeds of *B. Sinensis* yield Shanghai oil.

BRAUNITE, *brown'-ite*, a protoxide of manganese, occurring in Piedmont and Thuringia, in dark-brown square octahedrons. It contains 79 per cent. of manganese.

BRAXY, *brax'-e*, a disease of sheep, the word being variously applied to continuous diarrhœa, and to a blood disease which causes plethora. The too sudden change from poor to very rich pasture will often occasion diseases of this character.

BRAYERA, *brai-e'-ra*, a genus of plants belonging to the natural order *Rosaceæ*, sub-order *Roseæ*. The only interesting species is *B. anthelmintica*, a native of Abyssinia, the flowers of which constitute the drug known as Koussoo, or Cusso, which has been employed in both France and England with considerable success for expelling tapeworm. The flowers are apetalous and diœcious, and are imported in a dried state. The mode of administering the Koussoo is peculiar. About half-an-ounce is infused in a glass of warm water, and taken thus, flowers and water together, on an empty stomach. The flowers contain a considerable quantity of tannin, and an odorous principle to which the anthelmintic property is probably owing.

BRAZIL NUT. (*See* BERTHOLLETIA.)

BRAZIL AND BRAZILETTO WOODS. (*See* CÆSALPINIA.)

BREAD-FRUIT. (*See* ARTOCARPUS.)

BREAD-NUT. (*See* ARTOCARPACEÆ.)

BREAD-ROOT. (*See* PSORATEA.)

BREAD-TREE. (*See* CAFFER BREAD.)

BREAKERS, *brai'-kers* (Sax., *bræcan*, to break), a term applied to a peculiar kind of billows that may be easily distinguished by the white foam with which they cover the surface of the sea, and the terrible roaring noise which they produce. Breakers are generally found in shallow parts of the ocean, where rocks lie hidden below the surface, over which they break with great violence; and when once a ship is driven amongst them, it is almost impossible to save her, as every billow that heaves her up serves to dash her down again with additional force, when it breaks over the rocks or sands beneath.

BREAM, *breem* (Fr., *brème*) (*Abramis Brama*), a fish of the carp family, found in deep and still parts of rivers. In proportion to the length of the body, this fish is extremely deep and thin. In length, it is about two feet. Its flesh is not in very high repute. The Sea-Breams belong mostly to the family of the Sparidæ, and are nearly allied to the Gilt-head. (*See* GILTHEAD.)

BREAST, *brest* (Saxon, *breost*), is a term applied to the whole of the anterior part of the thorax. In a more restricted sense it is applied to the two globular fleshy protuberances adhering to the anterior and lateral regions of the thorax of females, and containing the mammary or lacteal glands. On the middle of each breast is a projecting portion termed the *papilla* or nipple, in which the excretory ducts of the glands terminate, and round which is a coloured orb or disc called the *aureola*. The use of the breasts is to secrete milk for the nourishment of newly-born infants. They are composed of common integuments and adipose tissue, in which are lodged numerous ducts radiating from the nipple, and afterwards dividing and subdividing into branches and twigs until they terminate in very minute vessels. The enlargement of the breasts is one of the signs of womanhood. Their fullest development commences in the earlier stages of pregnancy, and they continue to increase in size until about the time of delivery, when they are filled with the lacteal fluid, which passes readily on suction into the mouth of the child. The breasts of females are subject to a variety of disorders, one of the most common of which is inflammation. It may be produced by various causes, as a blow, exposure to cold or wet, great mental excitement, excessive accumulation of milk, or undue pressure on the parts. It occurs most frequently within the first three months after parturition, and is characterized by great heat, pain, redness, and swelling of the breasts. The pain is intense, and of a throbbing nature, and often extends to the axillary glands. The breasts become tense, heavy, and painful to the touch; and there is high inflammatory fever. The treatment consists in the application of warm fomentations to the part, and the administration of purgatives. If the inflammation do not subside in a few days, suppuration may be expected. In general the abscess may be left to nature; but when it occasions much pain it is advisable to get rid of it by a free incision. Chronic inflammation sometimes seats in the breasts, in which case stimulant applications will be found useful. Where this is attended with abscess, it should be opened, so as to give free exit to the pus, and pressure applied to the part. The breast is also subject to various kinds of tumours, some of which may be got rid of by simple pressure, and attendance to the general health. Sometimes some of the lactiferous ducts are blocked up, producing an enlargement termed lacteal tumour. It is to be remedied by puncturing the duct, and keeping it open for some time. Occasionally great pain and uneasiness is felt in the breast from sympathy with other parts of the system. There is no inflammation, swelling, or external alteration of the mamma, and yet the pain is excessive, usually intermittent. In this case the general health is chiefly to be looked after. Women are frequently subject to *sore nipples* after childbirth, occasioning great pain. In such cases care is to be taken to keep the nipples as dry as possible; and an application of glycerine is generally found useful. Nipple-shields of ivory or glass, with India-rubber teats, should also be used when the nipples are too tender to bear the application of the child's mouth. The most terrible disease to which the breast is subject is cancer. (*See* CANCER.)

BREATH, *breth* (Sax., *brath*), is the air which is inhaled and expelled in respiration. (*See* RESPIRATION.) Much can be gathered by the skilful physician as to the condition of the internal organs from the manner of breathing—if it be short and rapid, slow and laboured, painful, &c. *Fetid*, or *offensive breath*, to which some people are subject, may arise from a variety of causes, and is to be treated in as many different ways. Sometimes it is owing to a deranged state of the digestive organs, and in this case purgatives and tonics are to be administered. Occassionally it arises from a diseased condition of parts about the mouth or nose, as decayed teeth or morbid secretions about the tonsils. In such cases, the teeth should be frequently cleaned, and the mouth should be washed with a weak solution of chloride of lime or soda. Inhalation of steam from hot water, into which some creosote has been dropped, is recommended in cases in which the cause resides in the nose and respiratory passages. The injection of a lotion of sulphate of zinc or copper, by means of a syringe, into the nostrils will frequently be of use when the disorder has its seat there. Fetid breath may also arise from a diseased state of the lungs. Where it cannot be remedied, it will be well for the patient to chew a little cinnamon occasionally, or to take some of the aromatic pills prepared for the purpose.

BRECCIA, *brech'-cha* (Ital., a crumb or fragment), a rock consisting of angular fragments bound or cemented together by calcareous, ferruginous, or silicious matter. Such a rock differs from a *conglomerate*, or *puddingstone*, in having its component fragments irregular and sharp, whereas the pebbles of the latter are rounded and water-worn. (*See* CONGLOMERATE.)

BREEZE (It., *brezzia*), a shifting wind that blows during certain hours of the day and night, from sea and land alternately, and is only sensibly felt near the coast. The sea-breeze generally rises about 9 in the morning, proceeding slowly, in a fine curl on the water, towards the shore, gradually increasing until 12, and dies away about 5, when it is succeeded by the land-breeze, which also continues increasing until midnight, and is again followed, in the morning, by the sea-breeze. Breezes differ from *etesiæ*, or trade-winds, inasmuch as the former have their periods daily and nightly, and are only found near the coast, while the latter are annual and blow at a distance from land. (*See also* WIND.)

BREEZE-FLY. (*See* BOT-FLY.)

BRENT GOOSE. (*See* GOOSE.)

BREVIPENNES, *brev'-i-pen-nes* (Lat., short-winged).—A term applied to several birds of the order *Cursoria*. (*See* BIRDS.) Their wings are too short to enable them to fly, but are useful as an assistance in running. Their bodies are massive, and the muscles of the thighs and limbs are enormously thick, and they are generally able to run with great rapidity. The ostrich, emu, and cassowary belong to the brevipennes; and the gigantic *Dinornis*, and other fossil birds, belonged to the same class. All the brevipennes shun the presence of man, and generally inhabit desolate and solitary localities. Many of them, such as the emu and cassowary, are becoming very rare. The extinct Dodo belonged to the same order. The extinct and gigantic birds, whose footsteps are found on sandstones in Connecticut valley, appear also to have belonged to this tribe.

BRIGHT'S DISEASE, or GRANULAR DISEASE OF THE KIDNEYS, *brites*, is a particular disease of the kidneys, named after the late Dr. Bright, who first pointed out its nature and character. It consists in a degeneration of the tissues of the kidneys into fat, by which their secreting powers are impaired, and the urea is not sufficiently separated from the blood. The distinguishing characteristic of this disease is the existence of albumen in the urine, which, though not invariably, is almost always present, and is readily detected by its coagulating on the application of heat. Healthy urine contains no albumen, which is the great agent in nutrition. It is obtained here at the expense of the serum of the blood, and no disease so closely approaches hæmorrhage in its power of impoverishing the blood and exhausting its red particles. Hence arises that waxy and leucophlegmatic aspect which so strongly characterizes this complaint. Patients labouring under this disease are liable to inflammatory and congestive states of other important organs; and hence coma, convulsions, and apoplexy may occur during its progress. The heart, too, may become implicated, and dropsy almost always occurs, sooner or later. This disease may be occasioned by severe cold, repressed perspiration, or immoderate use of ardent spirits, and it not uncommonly follows scarlet fever. In the treatment, the secretions of the skin are to be encouraged by the use of warm baths and diaphoretics, and the dropsical tendency is to be counteracted, as far as possible, by purgatives and diuretics. Local bleeding is frequently beneficial, but general bleeding is to be avoided, from the exhausting tendency of the disease. The disease is, in some medical works, named Nephria.

BRILL, *bril* (*Rhombus vulgaris*), a fish resembling the turbot in shape, but inferior to it both as regards size and quality. The London market is chiefly supplied from the southern coast of England, where the brill is very plentiful. The brill is distinguished from the turbot by the perfect smoothness of its skin, which is covered with small scales, and marked with yellowish or rufous spots. As is the case with the turbot, the lateral line first describes an arc over the pectoral fins, and then runs straight to the tail. The brill very seldom attains an equal weight with the turbot, rarely going beyond 7 lb. It is found both in deep water, as well as in sandy bays.

BRIMSTONE, *brim'-stone* (Sax., *brenne stone*, a stone that burns.) (*See* SULPHUR.)

BRINE, *brine* (Sax., *bryne*), water saturated or highly impregnated with common salt. Brine is either natural, as when it flows from brine-springs, or artificial, when it is formed by dissolving salt in water. Brine-springs are fountains which flow with salt water instead of fresh. (*See* SALT and SPRINGS.)

BRINE SHRIMP (*Artemia salina*), a small crustacean of the order *Branchipoda*, found in salt water. It is about half-an-inch long, almost transparent and very lively in its movements.

BRINJAREE DOG, *brin-ja-re'*, a long-haired variety of greyhound, used in India for hunting, larger and stronger than the Persian greyhound, but inferior to the British greyhound in swiftness. It is generally of a yellowish or tan colour.

BRISTOL DIAMONDS, *bris'-tol*, small brilliant hexagonal crystals of white quartz, found in the limestone at Clifton, near Bristol.

BRITTLENESS, *brit'-tl-ness* (Ang.-Sax.), a property possessed by some bodies, which, although solid, have their component particles so arranged that the cohesive force which holds them together is overcome by comparatively small mechanical force. They can easily be reduced to powder. Brittleness is the reverse of malleability: as an instance, lead is malleable and glass is brittle.

BRITTLEWORTS. (*See* DIATOMACEÆ.)

BRIZA, *bri'-za* (Gr., *brizo*, I nod, on account of the quaking character of the spikelets), a genus of grasses, commonly known as Quaking-grass, or Maiden-hair. Two species are natives of Britain, the *B. major* and *minor*. Their dense clusters of flowers hang upon the ends of very delicate filamentous peduncles, forming elegant panicles, which shake with the slightest breath of air.

BROAD BILL. (*See* SHEVELLER.)

BROCCOLI, *brok'-o-le* (Ital., sprouts), the name given to one of the many cultivated varieties of the *Brassica oleracea*. It is a common garden vegetable, and differs from the cauliflower only in having coloured instead of white heads. (*See* BRASSICA.)

BROKEN KNEES, the abrasion or more serious injury sustained by a horse from stumbling. The value of a horse which has suffered from broken knees is deteriorated, as it is presumed to be unsafe.

BROKEN-WIND, a disease or unsoundness in horses, caused by a morbid secretion from the mucous membrane lining the larynx and the windpipe, with its many ramifications. The nature of the disease is not well understood, and the present mode of treating it is very unsatisfactory. Broken-wind is in reality incurable; and all that a veterinary surgeon can do is to mitigate the disease. Low-bred horses, which do not thrive, are most liable to broken-wind. While the horse is being exercised, the symptoms can be best observed. The eyes becomes suffused with blood, which is mostly impure, the nostrils are distended, and the breathing becomes very laboured. A broken-winded horse has always a hollow cough, and, if watched while at work, the ribs are noticed to be actively moved, and after the air is expelled from the lungs they are depressed with a sudden jerk, produced by the abdominal muscles. When employed on hard work, broken-winded horses often drop down and die from exhaustion or from suffocation, internal hemorrhage, or congestion of the lungs.

BROME-GRASS. (*See* BROMUS.)

BROMELIA, *bro-me'-li-a* (named after Bromel, a Swedish botanist), the typical genus of the natural order *Bromeliaceæ*. The green fruit of *B. pinguin* is used to destroy worms, and as a diuretic in the West Indies: the prickly leaves yield strong fibres, which are twisted into ropes, and woven into coarse cloth.

BROMELIACEÆ, *bro-me-li-ai'-se-e*, the

Bromelia, or the Pine-apple family, a natural order of monocotyledonous plants, sub-class *Petaloideæ*. Leaves persistent, crowded, channelled, rigid, sheathing at base, and frequently scurfy and with spiny margins; flowers showy; perianth superior, or nearly or quite inferior, arranged in two whorls, the outer of which has its parts commonly united into a tube, while the inner has its parts distinct, imbricated, and of a different colour; stamens 6; anthers introrse; ovary 3-celled, with a single style; fruit capsular or indehiscent, and 3-celled; embryo minute, in the base of mealy albumen, with the radicle next the hilum. There are 28 genera and about 175 species, which are distr buted through the tropical regions of America, West Africa, and the East Indies. They are chiefly important for yielding edible fruits and useful fibres. Some have worm-destroying properties, and others contain colouring matters. (*See* ANANASSA, BROMELIA, BILLBERGIA, TILLANDSIA.)

BROMUS, *bro'-mus* (Gr., *bromos*, wild oat), Brome-grass, a genus of plants belonging to the natural order, *Graminaceæ*. Many of the species are very common British grasses, especially the soft Brome-grass, which has soft downy leaves and is much liked by cattle. It is supposed but not sufficiently established that the seeds of Brome-grass are poisonous. Field Brome-grass and tall Brome-grass are very common.

BRONCHI, *bron'-ke* (Gr., *bronchos*, the windpipe), is the name given to the subdivisions of the trachea, or windpipe, which proceed to the lungs. The trachea divides into the two bronchi opposite the third dorsal vertebra. The right bronchus is larger than the left, and is shorter, reaching the lung on a line with the fourth dorsal vertebra. The left bronchus passes under the arch of the aorta. The structure of the bronchi is similar to that of the trachea, being round and cartilaginous in front, and flat, with muscular and fibrous tissue, behind. On entering the substance of a lung, the bronchi divide and subdivide into numerous branches, till they terminate in very minute air-cells.

BRONCHITIS, *bron-ki'-tis*, or inflammation of the lining membrane of the bronchial tubes. The great exciting cause is cold, especially when combined with moisture; but whatever tends to diminish the general vigour of the system, and excesses of every kind, predispose to it. Any sudden change of temperature is apt to produce it. It is especially prevalent during the spring months. Its first symptoms are generally those of a common cold, accompanied with an occasional cough and a sense of weariness and headache. The cough increases, and there is a feeling of oppression in the chest, and the breathing produces a kind of wheezing noise. The pulse is rapid and weak, and there is extreme lassitude, with pain in the limbs, mental heaviness, &c. If the feverish symptoms increase, the breathing becomes difficult from the clogging of the tubes with mucus, which is, to some extent, expectorated during the cough. In severe cases, the symptoms become more and more alarming; the breathing becomes so embarrassed that the patient can no longer lie down, but requires to maintain an upright posture and use all his muscles in respiration. At last, he is so exhausted that he ceases to expectorate, and dies of suffocation from the accumulated mucus, usually in from five to seven days. Even in less severe cases, the delicate respiratory tubes are frequently permanently injured; so that the proper aëration of the blood is interfered with. The treatment of this disease will vary, according to its nature and the constitution of the patient; and the necessity of always having recourse to a medical man cannot be too strongly insisted upon. The great object of the treatment is to reduce and remove the inflammatory condition of the organs: hence, a mustard-poultice should be applied to the chest, the feet bathed in hot water, and warm diluent drinks, as barley-water or linseed tea, given. It is frequently necessary to have recourse to emetics, in order to remove the accumulations of mucus. The bowels should be kept moderately open during the whole course of the disease. (*See* CATARRH, COUGH.)

BRONCHOCELE. (*See* GOITRE.)

BRONCHOTOMY. (*See* TRACHEOTOMY.)

BRONZITE, *bron'-zite*, a variety of diallage (*see* DIALLAGE) occurring in serpentine and greenstone. It is found in dark green foliated masses, with a pearly metallic lustre resembling bronze; whence its name. Chemically it is a silicate of magnesia, containing small portions of lime, protoxide of iron, manganese, alumina, and water.

BRONZE-WING, a name given to some species of pigeons in Australia, on account of the beautiful bronze colour of their wings. The best known species are the *Columba chalcoptera*, or ground dove; the *C. elegans*, the Brush Bronze-wing, and the *C. histrionica*, or pale green Bronze-wing.

BROOKITE, *brook'-ite*, oxide of titanium, crystallizing in thin masses; found on Snowdon and in Dauphiny.

BROOM. (*See* CYTISUS.)

BROOM-RAPE. (*See* OROBANCHACEÆ.)

BRORA BEDS; *bro'-ra*, a series of strata, containing coal seams of good quality, occurring at Brora, a village in Sutherlandshire. They are of the same age as the inferior oolite of Yorkshire.

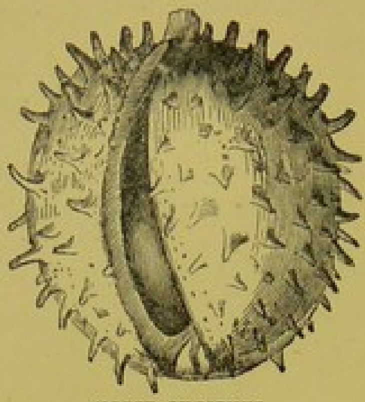
BROSIMUM, *bro'-si-mum* (Gr., *brosimos*, eatable), a genus of plants belonging to the natural order *Artocarpaceæ*, or Bread-fruit family. The species *B. utile*, sometimes called *Galactodendron utile*, is the celebrated palo de vaca, or cow-tree, of South America. It yields a milky juice, said to be almost as nutritious as milk from the cow. From the bark of *B. namagua* strong fibres are obtained, which are much used in Panama for making sail-cloth and ropes.

BROUSSONETIA, *broo-so-ne'-ti-a* (in honour of M. Broussonet, a French naturalist and traveller), in Botany, a genus of plants belonging to the natural order *Moraceæ*. There is but one species, *B. papyrifera*, the paper mulberry, the bark of which is used in China and Japan as paper material, and in the South Sea Islands for making a kind of cloth. The plant forms a small tree, with soft, brittle, woolly branches, and large, hairy, rough leaves, either heart-shaped and undivided, or cut into deep irregular lobes.

BROWN COAL, *broun kole*, a name used for lignite, in contradistinction to fine coal, which is black. (*See* LIGNITE.)

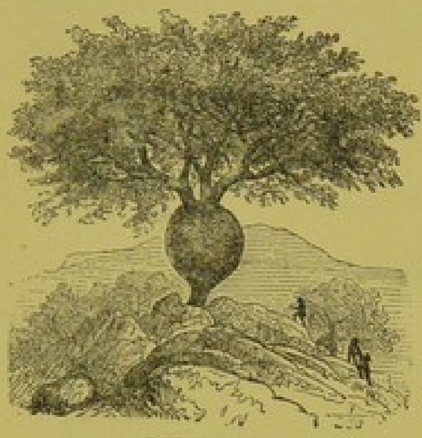
BROWN SPAR. (*See* DOLOMITE.)

CHAFFINCH.

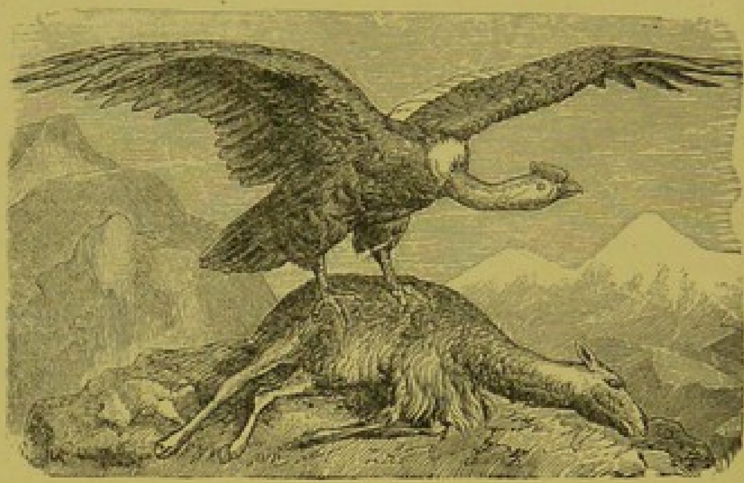


HORSE CHESTNUT.

CURASSOW.



BOTTLE-TREE.



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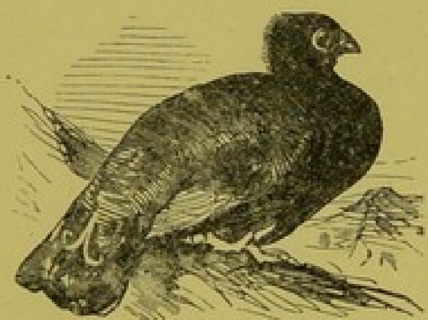
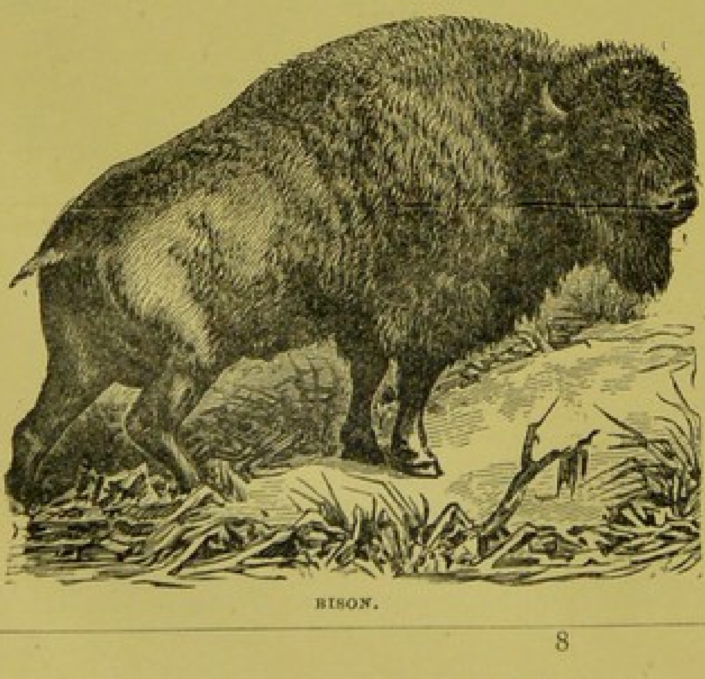


CAPERCAILZIE.

WILD BOAR.

BLACKBIRD.



BISON.

BIRCH.

BRUCEA, *bru'-se-a*, a genus of shrubs, natives of Abyssinia, the Indian archepelago, and China, the leaves of which are tonic and astringent. The name is taken from James Bruce, the traveller in Abyssinia.

BRUCINE, *bru'-sine*, an alkaloid occurring in large quantities in conjunction with strychnia in the *strychnos nux vomica*. It is less marked in its properties than strychnia, which it closely resembles. It crystallizes in colourless transparant rhombic prisms, which are insoluble in ether. Its poisonous properties are less active than those of strychnia. (*See* STRYCHNIA.)

BRUCITE, *bru'-site*, a fibrous hydrate of magnesia, occurring in silky greyish or bluish-white masses. A name given to chondrodite or chrysolite.

BRUNIACEÆ, *bru-ne-ai'-se-e*, the *Brunia* family, a natural order of dicotyledonous plants in the sub-class *Calyciflorœ*. They are small heath-like shrubs, found at the Cape of Good Hope and in Madagascar. Their properties and uses are unknown.

BRUNONIAN SYSTEM OF MEDICINE, *bru-no'-ni-an*, was founded by Dr. John Brown, a Scottish physician, who flourished towards the end of last century. His system is explained at large in his "Elementa Medicinæ," published in 1780. It found numerous supporters, and gave rise to much opposition. According to him, all diseases are of two kinds—*asthenic*, or diseases of weakness, or debility; and *sthenic*, or diseases of excess of strength. His mode of treating diseases, therefore, had for its object merely the increasing or diminishing of excitement, without regard to their particular symptoms. The doctrine, in its original form, may be considered as exploded; but more recently a sect has arisen, principally in Italy, who profess a modification of the Brunonian system, and who are known as Modern Brunonians. They advocate what is known as the *contra-stimulant* mode of treatment of disease.

BRUSH-TURKEY (*Talegalla Lathami*). This bird, called also the Wattled Tallegalla, inhabits New South Wales. It is about the size of a common turkey three parts grown. The whole of the upper surface is of a blackish-brown, the feathers of the chest edged with silvery grey. The skin of the head and neck is of a deep red, and the neck is ornamented with a bright yellow wattle. The most curious circumstance connected with the brush-turkey is, that it does not, like other birds, hatch its eggs by sitting on them, but collects together an immense heap of decaying vegetable matter as a depository for its eggs, and trusts to the heat evolved during the process of decomposition for the development of its young. This heap is gradually collected by the bird for several weeks previous to the period of laying, and is sometimes so large as to contain two or three cartloads.

BRUSSELS SPROUTS, a cultivated variety of *Brassica oleracea*, producing in the axis of the leaves small clusters of leaves which form miniature cabbages, they make a delicate table vegetable; chiefly in winter and spring. The seed is sown in February or March.

BRYACEÆ, *bry-ai'-se-e* (Gr., *bruo*, I sprout), Urn-mosses, a sub-order of the Moss family. (*See* MUSCI.)

BRYGMUS, *brig'-mus* (Gr., *brucho*, I grind my teeth), grinding of the teeth, or the gnashing and chattering of the teeth which takes place in epilepsy and other convulsive disorders.

BRYONIA, *bri-o'-ne-a* (Gr., *bruo*, I sprout), in Botany, a genus of plants belonging to the natural order *Cucurbitaceœ*. The most interesting species is *B. dioica*, the red-berried bryony, or wild vine, an indigenous perennial, growing in hedges and thickets, and blossoming during the month of May. The flowers are yellowish-white, with green streaks, and are diœcious; that is, the male and female flowers are borne by distinct plants. The stems are put forth annually, and climb by means of tendrils. The root is large, white, and is sold by herbalists under the names of white bryony and mandrake-root. (For the true mandrake, *see* MANDRAGORA.) The root contains a peculiar bitter principle, termed *Bryonin*. It is a violent emetic and purgative, and is highly poisonous, giving rise to symptoms much resembling those of cholera. It is stated to be frequently used by quack doctors in the country, and is employed as a topical application to bruises. *B. alba*, *Americana*, and *Africana*, have similar properties.

BRYUM, *bri'-um*, a genus of Mosses in the sub-order *Bryaceœ*. The species are very numerous, and many of them are natives of Britain. Their stems are short, and their leaves form tiny rosettes, from the centre of which the fruit-stalks spring.

BUAZE, *bu'-aize*, a South-African plant, found growing in the Maravi country by Dr. Livingstone. It affords a remarkably strong fibre, which is used by the natives for stringing beads upon. The botanical characters and relations of the plant have not yet been ascertained.

BUBALUS, OR BUBALIS, *bu'-ba-lus*, an antelope of Northern Africa, about the size of a large stag, with head and muzzle very like those of an ox, and two curved horns with the points directed backwards. The general colour is reddish brown, and the tail has a black tuft. It is easily domesticated.

BUBBLE, *bub'-bl* (Du., *bobble*), a small vesicle or bladder of water, or any other fluid inflated with air or gas.

BUBO, *bew'-bo* (Gr., *boubon*, the groin), a swelling of a lymphatic gland, particularly those of the groin or armpit. It may arise from mere irritation or some local disorder, in which case the bubo is termed sympathetic; or it may arise from the absorption of some irritating matter, or from constitutional causes.

Bubo. (*See* OWL.)

BUBONOCELE, a term applied to inguinal hernia. (*See* HERNIA.)

BUCCAL, *buk'-kal* (Lat., *bucca*, the cheek), denotes of or belonging to the cheek; as, the *buccal artery*, which is a branch of the internal maxillary; the *buccal glandules*, small mucous glands, or follicles, situated within the cheek, under its lining membrane.

BUCCINATOR, *buk-si-nai'-tor* (Lat., *buccina*, a trumpet), a muscle of the cheek, so called from being brought much into play by trumpeters.

BUCCINUM. (*See* WHELK.)

BUCEROS, *bu'-se-ros.* (*See* HORNBILL.)

BUCHU LEAVES. (*See* BAROSMA.)

BUCK, *buk* (Saxon, *bucca*), the male of the fallow deer. A buck is called a fawn in his first year; a pricket in his second; a sorel in his third; a sore in his fourth; a buck of the first head in his fifth; and a great buck in his sixth. The female of the buck is termed a doe. The male of the red deer is termed a stag, or hart, and never called a buck. (*See* DEER, STAG.)

BUCKBEAN, OR MARSH TREFOIL, *buk'-been,* a very beautiful plant (*Menyanthes trifoliata*) of the natural order, *Gentianeæ*, the only known species of its genus. It is common in Britain and in cold regions, grows in marshy places, and has long and closely matted roots which often make boggy ground firm. The stalk is long, and bears from ten to twenty white flowers, tipped with red. The leaves are very bitter, and a valuable medicine in cases of dyspepsia and disorders of the bowels is obtained from them. In Germany the plant is sometimes used as a substitute for hops.

BUCKEYE. (*See* HORSE CHESTNUT.)

BUCKHOUND, *buk'-hound,* a kind of dog formerly very common in England, but comparatively rare now. It was used exclusively for buck-hunting, and closely resembles the staghound but is smaller. Many varieties of hounds, beside the buckhound, are now used for deer-hunting.

BUCKLANDIA, *buk-lan'-de-a,* a magnificent evergreen tree of the natural order, *Hamamelideæ*, growing on the Himalaya Mountains. It grows unbranched to the height of 40 feet, and is not unfrequently seven feet in girth, with thick, bright, and glossy foliage.

BUCKTHORN. (*See* RHAMNUS.)

BUCKU, *buck'-u,* a name given to several small shrubs of the genus Barosma, natives of South Africa. They are used in medicine on account of their powerful action on the urinary organs.

BUCKWHEAT. (*See* FAGOPYRUM.)

BUD, *bud* (Du., *bot.*), the organized rudiment of a branch or flower. Buds which produce leaves, and have the power of extending into branches, are called *leaf-buds;* while those which produce flowers only, and are ordinarily destitute of this power of extension, receive the distinctive appellation of *flower-buds.* Theoretically considered, however, a flower-bud is merely a modified leaf-bud; for all the different parts of a flower may be regarded as altered leaves. A leaf-bud usually originates in the axil of a previously-formed leaf, the terminal bud of a branch being no exception to this rule. Every leaf has one or more of these organs in its axil, either in a rudimentary or perfect state. Whether lateral or terminal, each bud consists at first of a minute conical cellular mass, which communicates with the cellular tissue of the stem or branch. Around this, spiral and other vessels and wood-cells are soon developed, and these are also connected with similar parts of the wood. Outside all, in a cellular substance, which ultimately becomes the bark, the rudimentary leaves are developed. By the growth of these parts, a little conical body is produced, which, under favourable circumstances, develops into a branch resembling in every respect the parent axis. In temperate and cold climates, the buds, which remain dormant during the winter, are generally covered with modified leaves, called *scales.* These protective organs are usually of a hardened texture; sometimes they are covered with a resinous secretion, as in the horse-chestnut and several species of poplar; and sometimes they have a dense coating of soft hairs, or down, as in some of the willows. Buds thus protected are said to be *scaly.* In the buds of tropical regions, and those of herbaceous plants which are never exposed to the cold of winter, such protective organs would be useless, and are accordingly absent. These buds are distinguished as *naked.* In a few instances, even buds of perennial plants growing in cold climates are naked, like those of tropical plants: such is the case with the alder, and with the buckthorn. Within the leaf-bud the future leaves are often very curiously folded, or rolled up, and the different positions which they assume are highly characteristic of different kinds of plants. Leaf-buds are sometimes *extra-axillary;* that is to say, they are occasionally developed in other positions besides the axil of leaves. Such buds are termed *adventitious* or *abnormal.* The woody nodules, called *embryo-buds*, seen in the bark of the beech, elm, and other trees, are looked upon as partially-developed abnormal buds, in which the woody matter has been hardened by the pressure of the surrounding tissue. The nodules sometimes form knots on the surface of the stem; at other times they appear as large excrescences; and in some cases twigs and leaves are produced by them. Adventitious buds are produced naturally on the edges of certain leaves, and on the surfaces of others. These are capable of forming independent plants. Similar buds may be made to appear on the leaves of *Gesnera*, *Gloxinia*, and *Achimenes*, by wounding various parts of them, and placing them in moist soil: this is the method often pursued by gardeners in their propagation. Flower-buds, like leaf-buds, are ordinarily axillary, being produced in the axil of floral leaves or bracts. They cannot be used for budding, for they always die when removed from the parent stem. (*See* LEAF, FLOWER, BULB.)

BUDDLEA, *bud-le'-a* (after Adam Buddle, an English botanist of the 17th century), a genus of plants belonging to the natural order, *Scrophulariaceæ*. The species are shrubs, natives of the warmer regions of the world, and are remarkable for their gay and sweet-scented orange-coloured flowers. *B. neemda* is said to be one of the most beautiful plants of India. *B. globosa*, a native of Chili, is hardy enough to endure the climate of most parts of England, and has become a common ornament of our gardens.

BUFFALO, *buf'-fa-lo,* (Ital. and Span., *bufalo.*) This animal (*Bos Bubalus*) differs from the bison in having no hump on the back, and only a small dewlap on the breast. Besides this, it carries no shock of hair about its neck and shoulders. Buffaloes generally live in flocks of about a hundred, and affect marshy regions, both on account of the coarse but luxuriant vegetation there to be found, as well as the opportunity for a "mud" bath, of which the buffalo is remarkably fond. The way he indulges this predilection is singular: throwing himself flat upon his side in the mire, he shuffles round and round, the soil yielding to his immense weight the exudation of any moisture it may contain, till he manufactures for himself a delicious basin of mortar covering him to his very eyes. When he emerges and has basked awhile in the sun, he looks like some hideous slack-baked clay image. This manœuvre, however, is not without purpose. Among the rank vegetation, and in the air, swarm millions of stinging flies, and until the buffalo's mud coat peels off through long wear, he is as impregnable to their attacks as the clay image he represents. The buffalo is one among the very few animals who manifest no fear at the approach of the tiger; indeed, sportsmen concur that unless a tiger be full-grown, and in possession of all his strength, he will not venture to attack the bull buffalo. Should the tiger, made desperate by hunger, attack a herd of buffaloes, his fate is certain. The whole herd will band against the common foe, and, assailing him with hoofs and horns, trample him maimed and crushed into the mire. In India, Egypt, and the south of Europe, the buffalo is employed as a beast of burden. It is larger than the ox, and more powerful, but generally very docile. The Cape Buffalo (*Bos Caffer*) is generally regarded as a distinct species. It has immense horns spreading in a dense mass over the top of the head. It has never been domesticated; and is regarded by hunters as the most formidable beast of South Africa. The Kaffirs make shields of its impenetrable hide.

BUG, *bug* (probably Welsh *bwg*), a name given, especially in America, to a large family of insects, *Cimicidæ* of the order *Herupitera*. In England the name is commonly limited to the too familiar and abominable bed-bug (*Cimes lectutarius*), which differs from other members of the family in having no wings, which is the only point in their favour, for if they could fly, life, where they abound, would be unendurable. It is commonly asserted, though with what degree of truth it is hard to say, that before the year 1670 the insect in question was unknown in England, and that it was imported from America with the timber that country furnished for the rebuilding of London after its destruction by the great fire. The female bug deposits her eggs at the beginning of summer: they are small, white, and of an oval shape, each being fixed to a hair-like glutinous stalk, ready to adhere to anything it touches. Some members of the bug family suck the blood of birds and small animals; but many live on the juices of vegetables, some of the winged bugs of tropical climates are as large as cockchafers. They suck blood and emit a most revolting odour.

BUGLE, in Botany. (*See* AJUGA.)

BUGLOSS. (*See* ANCHUSA.)

BUHR-STONE, *boor*, a name given to certain quartzose rocks the worked surfaces of which possess the property of cutting or grinding. They are used principally as millstones. The best kinds are creamy white, with a granular and somewhat cellular texture, and are obtained in the tertiary formation of the Paris basin and the surrounding district. They are cut into wedge-shaped parallelopipeds called *panes*, which are bound together with iron hoops to form large millstones.

BUKKUM-WOOD. (*See* CÆSALPINIA.)

BULB, *bulb* (Lat., *bulbus*), a shortened stem or branch, usually subterranean, bearing on its surface a number of fleshy scales, which are modified leaves. It is only found in monocotyledonous plants, and is seen in the hyacinth, lily, and onion. The bulb may be looked upon as a subterranean leaf-bud, arising from a shortened axis. From its centre an herbaceous stem arises, and from the subterranean axis new bulbs, or *cloves*, as they are called, are produced. Every new bulb is formed in the axil of a scale, like a bud (which *see*); sometimes it remains attached to the parent bulb, and sends up an axis and leaves; at other times, it is detached in the course of growth, and forms an independent plant. The new bulbs feed on the parent one, and ultimately cause its complete absorption. The scales are generally thickened by the decomposition of nutritive matters, intended for the future use of the plant. In the onion, squill, and leek, these scales are covered externally by thin membranous coats or tunics: hence the bulbs are said to be *tunicated*. When the membranous coats are absent, the bulb is said to be *naked* or scaly, as in the white lily. The solid rounded underground stem, called by botanists a *corm*, is commonly regarded as a bulb. (*See* CORM.)

BULBILS, OR BULBLETS, *bul'-bils*, small conical or rounded bodies produced in the axil of the leaves of some monocotyledonous plants, and which are of the nature of bulbs. They can be readily distinguished from ordinary leaf-buds by their fleshy character. They are easily detached from the parent stem, and, when placed in favourable circumstances, they produce new individuals. They may be seen in *Lilium bulbiferum*, *Dentaria bulbifera* (coral-wort), and *Ranunculus ficaria* (pilewort).

BULIMIA, *bul-i'-mi-a* (Gr., *bous*, an ox, and *limos*, hunger), denotes an insatiable craving for food. The real nature of this disease is very imperfectly known. In some cases, the health appears to be otherwise good; but usually bulimia is a concomitant of other diseases. Its consequences are leanness, pulmonary fevers, consumption, or dropsy.

BULL, (Dutch, *bulle*), the male of the *bos* or bovine genus of quadrupeds, of which the cow is the female.

BULLA, a genus of molluscous animals with univalve shells, whose general characteristics are,—that the shell is sub-oval, that the aperture is oblong and smooth, and that one end is a little convoluted. The animal breathes by gills, but has no respiratory tube, and consequently the margin of the aperture of the shell is entire. Most of this genus, especially of the larger sizes, are furnished with an organ exactly resembling the gizzard of a fowl, and which they appear to use for the purpose of masticating their food. All the species are marine, and some are found on the British coasts.

BULLACE, *bul'-laise*, the English name of a kind of plum, the *Prunus insititia*. (*See* PRUNUS.)

BULL-DOG, *bull'-dog* (*Canis molossus*), a variety of the dog, remarkable for its broad, short muzzle. It is generally looked upon as an essentially English dog; but there is a doubt as to whether it has not existed as a definite race since the time of the Romans, or whether it is not a recently-formed variety of mastiff. It is smaller than the mastiff, and has a massive head;

the forehead sinks between the eyes, and the nose-line rises again at a considerable angle; the lower jaw projects in a remarkable manner beyond the upper, continually showing the teeth; the lips are thick and pendulous, the neck strong and thick, and the legs short. The projection of the under-jaw and the livid redness of its eyes give the bull-dog a fierce and forbidding aspect, often heightened by a designing leer, which seems natural to the animal. The strength and courage of bull-dogs are proverbial. They will attack any animal, utterly regardless of its strength and size. They were formerly much used for bull-baiting; since the abolition of which sport, the breed has decreased in numbers. One of these dogs will seize an ox by the nose, and, with apparent ease, hold him still, or throw him on his side, as he is ordered by his master. When trained for the purpose, they fight very savagely with one another; and in certain of the mining and manufacturing districts of England this sport is still carried on. On growing old, the bull-dog becomes very vicious and dangerous, often inflicting severe bites on the slightest provocation. The bull-terrier is a cross between the bull-dog and the terrier. It is more pugnacious even, if less doggedly ferocious, than the bull-dog itself; but possesses also more amiable qualities and exhibits great affection towards its friends.

BULLET-TREE, OR BULLY-TREE, a tree supposed to belong to the genus *Mimusops*, in the natural order *Sapotaceæ*. It is a native of Guiana, and much valued for its timber, which is hard and durable. It yields a delicious fruit about the size of a cherry.

BULLFINCH, *bull'-finsh* (Ang.-Sax.), a song-bird, *Pyrrhula vulgaris* of the family of *Fringillidæ*, common to all parts of England and Europe generally, and throughout Asia. It is about the size of the common hedge-sparrow, but of bulkier build, the bill is short, strong, and of a blue-black colour. On the upper part of the head, round the base of the beak, and forming a chin-shaped patch beneath, jet black predominates; the back is ash-grey; breast and belly dusky read; wings and tail black; upper tail-coverts white; legs dark brown. The female resembles the male, except that her colours are less distinctly marked, and her under-parts are rather russet than red. The bullfinch has acquired considerable celebrity from the facility with which it learns to whistle airs. Training bullfinches to "pipe" is a mode of making money frequently practised in Germany: considerable pains are requisite, the time required frequently extending to nine months. The bullfinch is very easily domesticated and becomes very fond of those who feed and notice it.

BULL-FROG (*Rana pipiens*), the largest of the species *Rana*, or Frogs. It is generally six to eight inches long, exclusive of the feet, and four inches broad. It is an inhabitant of North America, particularly of the southern states. At a distance, its voice resembles the lowing of a bull; hence its name. The fore feet of the bull-frog are unwebbed, and have only four toes; but the hind feet, which are long, are webbed very widely. Its colour is a dull olive, marked irregularly with dark stains; the belly, however, is of a pale green colour, thickly spotted. The bull-frog frequents springs only where the constant running of water has made a deep pool. Scarcely a spring of this description is without a pair of these frogs. They prey on young ducks and geese, which they swallow whole; it is also believed that they keep the springs in which they reside wholesome. The hind legs are eaten, and are said to be of good flavour.

BULLHEAD OR MILLER'S-THUMB, *bull'-hed* (*Cottus Gobio*), a small fish, common to brooks and rivers. It is about four inches long, with a large roundish head, and a capacious mouth, formidably filled with teeth. It is generally found under loose stones at the bed of the stream, and is seemingly so insensible to danger, that, should half-a-dozen of them be lying together, the juvenile angler may capture the whole by continuing to drop in his bait till they are all hooked. A seafish of a nearly allied genus, *Aspidophorus*, is sometimes called the Armed Bullhead.

BULL-TROUT, *bull'-trout* (*Salmo Eriox*, or *Salmo griseus*). This fish, which is often called the Grey Trout in England, and the Sewen in Wales, is nearly allied to the salmon. It generally lives in the sea, but deposits its spawn in rivers. Its form is not so elegant as that of the salmon; its head and neck are thicker, and its tail more bulky in proportion. The colour of the male is reddish brown, and that of the female dark grey; their scales are smaller than those of a salmon of equal size. Anglers look upon the bull-trout as ranking next to the salmon as regards sport. It is usually under 15 lbs. weight, but some attain a weight of 20 lbs. The flesh, which is lighter coloured than that of the salmon, is coarser, and has not so delicate a flavour. The name has also been given to the salmon of the Danube (*Salmo Hucho*) a very much larger fish.

BULLRUSH, *bull'-rush*, the popular English name for any large rush-like plant growing in marshes. (*See* TYPHA, SCIRPUS.)

BUMASTUS, *bu-mas'-tus*, a genus of Silurian trilobites, remarkable for their oblong-oval or grape-like form. They occur in large numbers in the limestone of Barr, in Staffordshire, and on this account are commonly called the "Barr trilobites."

BUMMALOTI, *bum-ma-lo'-ti* (*Saurus ophiodon*), a fish taken off the coasts of India, commonly known as the "Bombay duck." The flesh, salted and dried, is highly esteemed as a relish. It is a long fish, with a large mouth, and is extremely voracious. Some naturalists class it with the Salmonidæ.

BUNIAS, *bu'-ni-as*, a genus of plants of the natural order *Cruciferæ*, natives of the Levant. One of the species *B. Orientalis*, is cultivated in France and some other countries, the leaves being used as food for cattle. In this country it is sometimes known as Hill Mustard.

BUNION, *bun'-yun* (Gr., *bounos*, an eminence), a painful inflammatory swelling of the foot, most commonly about the root of the great toe. It is caused by a gradual displacement of the bones. The pressure of tight shoes is usually the exciting cause; and, in order to remedy it, all such pressure upon the part should be avoided. Warm fomentations, or poultices, should be resorted to, in order to remove the inflammation; but surgical operation is sometimes necessary.

BUNIUM, *bu'-ni-um*, in Botany, a genus of plants belonging to the natural order *Umbelliferæ*. The species are perennial herbs, with usually tuberose and globose roots, square stems, compound leaves, and white flowers. *B. flexuosum* and *bulbocastanum*, both growing wild in this country, have edible tubers, which are commonly known as earth-nuts or pig-nuts. *B. ferulaceum*, a native of Greece, has also edible tubers, which are termed topana.

BUNT, *bunt*, a disease of wheat and other grains, caused by a parasitic fungus. It is also known as Pepper Brand and Smut Ball.

BUNTER, *bun'-ter* (Ger., variegated), the term applied by the Germans to the new red sandstone of English geologists, in allusion to its variegated colours. (*See* TRIASSIC SYSTEM.)

BUNTING (*Emberiza*), an interesting group of passerine birds, whose chief characteristic is a bill very strong, short, conical, and compressed laterally, but without any tooth or notch; the upper mandible is narrow, turned in at the edges, and with a bony knot at the palatal end, forming, as a whole, an instrument admirably adapted for breaking the rinds or shells of seeds, and ejecting them without losing any of the kernel. The Common, the Yellow, the Cirl, the Ortolan, the Snow, the Reed, and the Lapland, are the various distinguishing names of the British members of this family. Besides these there are the Black-throated bunting of the south-western and middle states of North America; the Painted bunting of South America, and the Yellow-shouldered bunting of the Cape. When the female of this last-mentioned species loses, through age, the faculty of propagating her kind, she throws off her comparatively modest attire, and appears for the rest of her life, as splendidly plumed as her mate; and so exactly like, that it is simply impossible to tell one from the other without the minutest examination.

BUPHAGA AFRICANA, *bu-fai'-ga*. (*See* BEEFEATER.

BUPRESTIDÆ, *bu-pres'-ti-de* (Gr.), a genus of hard-shelled beetles, generally very beautiful in appearance. Green would seem to be their most ordinary colour, but many are of the richest azure, spangled with gold-colour; some are vivid red, and others of a glowing copper hue. They are found on the trunks and branches of trees, and, when disturbed, will fall to the ground seemingly without life, and by this means frequently escape. There exist nearly five hundred of this genus, but not more than twenty are commonly met with in this country. One of the largest species, *B. gigores*, a native of Cayenne, is about two inches long. Some of the species are known as Golden Beetles, or, in America, Golden Bug.

BUR, BURR, OR BARB, *ber*, a very small ridge raised on the edges of lines that have been cut on a plate of metal by the action of the graving-tool or dry-point. It is generally removed by a tool called a scraper, as it gives a somewhat smeared appearance to impressions taken from the plate if it be allowed to remain. In plates engraved by Rembrandt the bur was not removed, and he managed to take advantage of it to give additional effect to his etchings.

BURATITE, *bu'-ra-tite*, a hydrated carbonate of copper, containing also zinc and lime, occurring in the radiating needles at Chesey in France, and in the Altai Mountains.

BURBOT, *ber'-bot* (*Lota vulgaris*), a fish of the same genus as the Ling, the only British fresh water fish of the family *Gadidæ*, found in many northern English lakes and rivers, and in many parts of the north of Europe and Asia. The ordinary weight is two or three pounds; but frequently that weight is greatly exceeded. It is of a yellowish brown colour, spotted with darker brown on the upper parts. The whole body is covered with a mucous secretion. The flesh is white, firm, and of good flavour.

BURITI PALM. (*See* MAURITIA.)

BURMANNIACEÆ, *bur-man'-ni-ai'-se-e*, the *Burmannia* family, a natural order of monocotyledonous plants in the sub-class *Petaloideæ*. This order is said to include 10 known genera and 38 species, natives of the tropical parts of Asia, Africa, and America. They are herbaceous plants, without true leaves, or with tufted radicle ones.

BURNET, *bur'-net*, the English name of two genera of plants belonging to the natural order *Sanguisorbeæ* (*see*). The Great Burnet (*Sanguisorba officinalis*) is a common meadow plant of Europe, and cattle are very fond of it. It is nearly two feet high and has flowers with dark red spikes. The Common Burnet (*Poterium Sanguisorba*) is rather smaller, and the flowers are of a dull purplish colour. It is common in England in the chalk districts, especially on the South Down and Salisbury Plain.

BURNING, *burn'-ing* (Sax., *byrnan*, to burn), the action of fire or heat upon any combustible matter, by means of which the constituent particles of the substance acted upon are rapidly oxidized and converted into vapour and ashes, or into calx.

BURNS AND SCALDS, *burns, skawlds*, are injuries done to the body through excessive heat; burns being produced by fire or heated solids, scalds by heated fluids. Scalds seldom penetrate deeper than the cutis; burns, on the contrary, may penetrate to any depth. Burns are more fatal in the young and old than in those of middle life, and are more dangerous on the head or trunk than on the extremities. A burn affecting an extensive surface is more to be dreaded than one which penetrates deeper without extending over much surface. Where the skin is blistered, cold evaporating lotions should be applied; as, camphorated spirits of wine, sugar-of-lead lotion, or cold water, so as to prevent the blisters from bursting, and to lessen the inflammation. The blisters may be pricked with a fine needle, in order to allow the serum to escape; but care is to be taken not to admit the air, and on no account is the raised cuticle to be removed. When the cuticle is destroyed, and the inflamed cutis exposed, spirit of turpentine is the best application that can be used in the first instance. A mixture of lime-water and milk, or of lime-water and olive-oil, will also be found useful. In more serious cases of burning, arising from clothes taking fire, the explosion of gunpowder, &c., the patient frequently, immediately after the accident, falls into a state of collapse, occasioned by the shock. Stimulants, as brandy, are to be freely administered, to prevent the patient from dying from the shock; and warm lime-warm and oil or milk, or spirits of turpentine, are to be applied to the parts. In the antiphlogistic treatment now adopted, much care has to be observed, as it is necessary to keep up the patient's strength. Poultices may be applied to the deeply-burnt parts, in order to expedite suppuration and the separation of the sloughs. When the sloughs have separated, and suppuration is established, cicatrization commences. The poultices are now to be laid aside, and moderately stimulating ointments to be applied. Extensive burns may prove fatal in any stage and the patient, especially if young, or advanced in years, can seldom be pronounced free from danger until cicatrization has been completed. In removing the clothes from the burnt parts great care is to be taken not to break any blisters that may be raised, as a great object is to exclude the air from raw or inflamed surfaces.

BURSÆ MUCOSÆ, *bir'-se mu-co'-se* (Lat., mucus-bags), small membranous sacs, situated about the joints of the bones, and containing a kind of mucous fat, which serves to lubricate the joints, in order to render their motion easy. They are of different sizes and firmness. *Bursalogy* is the name given to a description of the *bursæ mucosæ*.

BURSERA, *bir'-se-ra* (so named in honour of Burser, the naturalist), a genus of plants belonging to the natural order *Amyridaceæ*. The species *B. gummifera* and *acuminata* yield fragrant resinous substances, that from the former being termed Chibou, or Cachibou resin, and that from the latter, resin of Carana.

BURYING-BEETLE (*Necrophorus*), a genus of *Coleoptera*, found in Europe and North America. They have received their name from a remarkable habit they have of burying the bodies of dead birds, mice, moles, and other small animals, in which they deposit their eggs. One of the species is a native of Britain, the *Necrophorus vespillo*. It is a black-beetle about an inch in length, and has two bright orange bands across the back. It has an intensely fœtid odour, and the hands smell for hours after touching it. In this country they feed upon putrefying dead bodies and the garbage that is thrown out near towns, as soon as it begins to smell. They hunt in couples, and as soon as they find a dead bird or mouse, they alight upon it, and, after feeding, the male commences his work of interment. This is done by digging with his head alone a trench round the dead object; a second trench is then dug within the first, and then another, until the earth is entirely excavated. The dead bird or mouse then falls into the hole thus formed. As soon as the corpse is fairly dragged to the bottom of its grave, the beetle quickly throws back the removed earth, and both insects bury themselves in the body. After the female has deposited her eggs, the pair work their way out. The larvæ are whitish, with six feet and a brownish head.

BUSH ANTELOPE, OR BUSH GOAT, are names given to several species of antelopes, natives of the southern and western parts of Africa. (*See* ANTELOPE.) They are not so light and graceful as the typical antelopes.

BUSSU PALM. (*See* MANICARIA.)

BUSTARD, *bus'-tard* (Fr., *bistarde*), the largest of European land birds. When full grown, the Great Bustard (*Otis tarda*) weighs from twenty-five to thirty pounds. It is about four feet long, and across its extended wings measures three yards. The head and neck are ash-coloured, and there is a tuft of feathers about five inches long on each side of the lower mandible. The bustards generally live in open countries dotted with low bushes, a locality which gives them the advantage of a broad look-out and secures them from surprises by enemies. They are said seldom to use their wings for aërial locomotion, but as adjuncts to their long legs in running. The speed they make this way is considerable, and may be sustained a very long time. The bird is still found in parts of France and Germany, and is common in Russia and on the extensive plains of Tartary. In this country, however, it has long been rare, indeed, may be almost considered as extinct. Yet that they were sometimes common is certain, so common as to be a looked-for dish at feasts and banquets. One of the bustard's chief peculiarities is a singular pouch, shaped like a modern soda-water bottle, and hanging immediately beneath the base of the lower mandible. The real use of this pouch has not been ascertained. The Little Bustard (*Otis Tetrao*), though common in France, Sardinia, and Italy, is very rarely seen here: it is also found in North Africa, Turkey, and Greece. It is about eighteen inches in length. It is a very shy bird, and when disturbed, escapes by alternately running and flying. The Kori Bustard (*O. Kori*) of South Africa, and the Australian bustard (commonly known as the wild turkey), are very large and handsome birds; the former, indeed, approaches the ostrich in size.

BUTCHER-BIRD (*Lanius excurbitor*). The sanguinary title of this member of the Shrike family, received from Gesner two hundred and fifty years ago, arises not only from its savage and cruel disposition, which seems to lead it to kill for the pleasure of killing, but also from its singular habit of impaling its victims on thorns and twigs, and in that position tearing and devouring their carcasses to piecemeal. It is about the size of a common thrush. Its bill is black, and furnished with bristles at the base; the upper parts of its plumage pale blue, and its under-parts white. It is common all the year in France, but in this country is only a rare winter visitant. When confined in a cage, the same love of fixing its food before it tears it to pieces is discovered, and for this purpose the bird usually avails itself of the wires of its prison, to which it hangs its dead captive. Another of these shrikes (*Lanius collaris*), a native of Southern Africa, exhibits this carcass-suspending propensity in as marked a manner as the above. The Hottentots assured Le Vaillant that this bird does not prefer fresh food, and that its motive for hanging its carcasses was much the same as prompts some of us to hang venison and game. A curious result sometimes follows this habit of the African shrike. Beneath the scorching sun of that region the process of decomposition does not always take place, from the rapid exhalation of the animal moisture; consequently, the trees and shrubs are sometimes found bearing amongst their fragrant buds and blossoms many ready-dried specimens of the small birds of the country.

BUTEA, *bu-te'-a* (named after, John, earl of Bute, a great patron of botanists), a genus of plants belonging to the natural order *Leguminosæ*, sub-order *Papilionaceæ*. The most important species is *B. frondosa*, a native of India. This tree yields an astringent gum called *butea gum*, which resembles kino in its properties, and is sometimes forwarded to this country under that name. It is used medicinally in India in diarrhœas and similar diseases; also for tanning.

The dried flowers of this species and those of *B. superba* are known as Tisso and Kessaree flowers, and are extensively used by the Indians in the production of beautiful yellow and orange dyes. The fibres of the inner bark of *B. frondosa* (the Dhak tree) are known under the name of *Pulas cordage*.

BUTOMUS, *bu-to'-mus* (Gr., *bous*, an ox; *temno*, I cut), the typical genus of the natural order *Butomaceæ*. *B. umbellatus*, the common flowering rush, is frequent in ditches and ponds in England and Ireland, but is very rare in Scotland. The leaves, which spring from the crown of the root, are from two to three feet long and of a triangular shape. The scape or flowering stem is longer than the leaves, and terminates in a large umbel of rose-coloured flowers. The plant possesses acrid and bitter properties, and was at one time used in medicine. The roasted rhizome is edible. The sharp leaves of the *Butomus* were believed to cut the mouths of the cattle that cropped it—whence the name.

BUTTERCUP. (*See* RANUNCULUS.)

BUTTERFISH. (*See* GUNNET.)

BUTTERFLY, *but'-ter-fly* (so named from the colour of the yellow species) (Sax., *buterflege*), the name of an extensive group of the order *Lepidoptera* which fly by day. They are distinguished from other insects by these generic characters: The antennæ are terminated by a knob, or at least are somewhat suddenly thicker at the extremity; by the beauty as well of the under as of the upper side of their wings, which are usually erect when the animal is in a state of repose. They possess four wings, covered with minute scales, which to the naked eye appear like powder. Butterflies are the only lepidopterous insects which have no spines, bristles, or hooks on the margins of their wings, by which the second wing on each side can be attached to the first. The number of British *Papilionidæ* is not more than seventy; and it singularly happens that some of these affect particular localities, sometimes of an area of but a few acres, and are never elsewhere seen. Even on such favourable spots their appearance is limited to a few days in a certain season of the year. Another peculiar circumstance is, that several species appear in certain localities, at intervals of several years, when they will literally swarm; come the next season, and not a solitary one will reward the most diligent searcher. This might be attributed to the variable character of our climate, but it is well known that in tropical countries the same irregularities occur. Butterflies are found in all parts of the world; in tropical regions flying together in an apparantly compact mass, one or even two miles in extent. They vary in size from one inch to ten or eleven inches across the expanded wings, the largest species being tropical, and the colours displayed by some are remarkably rich and varied. The caterpillars have always sixteen feet. The external form of the chrysalids varies according to the species of butterfly that inhabits them; in all, however, there are apertures opposite to the thorax, by which respiration is carried on during the whole period of their inactive state. When the entombed creature has acquired sufficient vigour, and the down already grown upon it has separated it on all sides from the shell, the latter is broken through by the insect's head, and it emerges a butterfly. At first, however, the wings are closely folded to its body; but they soon expand of themselves, and are sufficiently hardened by the air to endure the effort of flying. It is not, however, every chrysalis that becomes a butterfly, probably not a thousandth part of their number do. Both in a caterpillar and in a perfect state they are surrounded by ever-hungering enemies. Many species of the Ichneumonidæ perforate the body of the caterpillar and there deposit their eggs; and although the caterpillar continues to live, and is transformed into a chrysalid, no butterfly is produced from it, those internal parts which were essential to its perfection being consumed. Sparrows and other birds are mortal foes to butterflies, and a single pair will easily dispose of between three and four hundred in the course of a single week.

BUTTERFLY FISH. (*See* BLENNY.)

BUTTERFLY WEED, sometimes known as Pleurisy Root (*Asclepias tuberosa*). (*See* ASCLEPIAS.)

BUTTERWORT. (*See* PINGUICULA.)

BUTUA ROOT, *bu'-twa*. (*See* CISSAMPELOS.)

BUTYL, *bu'-tile*, an organic radicle, discovered by Kolbe amongst the products obtained by electrolysis from valerate of potash. It may also be prepared by the action of sodium on iodine of butyl, in a vessel so arranged that the volatilized products may return into it as fast as they are volatilized and condensed. When the reaction has terminated, the butyl may be distilled off at a temperature not exceeding 300° Fah. When pure, it is a limpid oil, with an agreeable ethereal odour. It boils at 226° Fah., and may be distilled without alteration. It is one of the lightest known fluids, its specific gravity being only 0·694. It is the radicle of a great number of very interesting organic compounds. It has been called valyl by certain chemists, from being formed from valeric acid, and by others tetryl.

Butylic Ether, or Oxide of Butyl, *bu-til'-ik* was first described by Kolbe as a product of the voltaic decomposition of valerate of potash. It is at present but little known. *Butylic alcohol*, or hydrated oxide of butyl was discovered by Wurtz in beetroot molasses. It is a colourless highly refractive liquid, boiling at 228°, and has a slightly vinous odour, somewhat resembling that of amylic alcohol. Its specific gravity is 0·803. It is quite similar in properties to the other alcohols of the same group.

Butyline, *bu'-ti-line* (C_8H_8), butyl less one equivalent of hydrogen. This compound was discovered by Faraday amongst the products of distillation of oil, and is frequently called oil-gas. It is a colourless gas, burning with a white luminous flame. It is one of the principal products of the distillation of India-rubber. It was afterwards obtained by Kolbe from valerate of potash, and by Wurtz by acting on butylic alcohol with chloride of zinc. It is similar in its properties to ethyline (C_4H_4), or olefiant gas, the corresponding product of ethyl.

BUXBAUMIA, *bux-bau'-me-a*, a genus of mosses. Only one species is known, *B. aphylla*, a very rare British plant. It appears to consist of a little conical bulb, with minute scales, which are really leaves.

BUXUS, *bux'-sus* (supposed to be from Gr., *puknos*, dense, in reference to the wood), the Box, a genus of plants belonging to the natural order *Euphorbiaceæ*, and consisting of evergreen shrubs or small trees with opposite leaves, entire at the margins, and easily split into two plates. The flowers, which are very small, grow in little axillary clusters, the male and female flowers being distinct, but borne on the same plant. There are only two species known: namely, *B. sempervirens* and *B. balearica*. The former, which is the common box, is remarkable, botanically, for being the most northern arborescent species of *Euphorbiaceæ*. In Britain, it seldom attains a height of more than twelve or fourteen feet; but, in the south of Europe, it is often twice that height. It grows wild in this country only on the dry chalky hills of the south. Many varieties are known in gardens, the most remarkable of which is the dwarf-box, so much used for the edgings of walks. The wood of the arborescent *B. sempervirens* is heavier than that of any other European tree, and will sink when placed in water. It is of a beautiful pale-yellow colour, and of a fine regular and compact texture. It is preferred to every other kind of wood for the manufacture of flutes, flageolets, and other wind instruments; of rules and mathematical instruments; and of the handles to most small tools. For the purposes of the turner, the wood-carver, and especially of the wood-engraver, boxwood is invaluable on account of the closeness of grain. *B. balearica*, the Turkey, Minorca, or Balearic box, forms a larger tree than the other species, and has leaves three times as large. It is much more impatient of cold, but is occasionally seen in shrubberies in the south of England. The wood is of a bright yellow, and much inferior to the true boxwood, for which it is often substituted.

BUZZARD, *buz'-zard* (Dutch, *buzaard; Buteo vulgaris*), a predacious and carrion-feeding bird, common to the whole of Europe. It is a sluggish bird, and its courage is not nearly commensurate with its size; for, while it measures nearly two feet in length, and its extended wings cover a breadth of nearly five feet, it will flee from the attack of a magpie or jackdaw. Like the kite, the raven, and all birds that feed much on carrion, the buzzard has a lofty flight when in search of food. In colour it is reddish-brown above, and white or cream-colour beneath; the tail is barred with black and ash-colour, and has a white tip. The bird's beak is comparatively small and feeble. It breeds in extensive woods, builds a ragged nest, and lays two or three eggs, which are either wholly white or white blurred with yellow. If during the period of incubation the hen should be killed, the male bird will take upon himself the business of hatching and rearing the brood. The honey-buzzard, or pern (*Pernis apivorus*, Cuvier), is a little longer than the common buzzard, and not so bulky. The crown of the head is of a pure bluish ash-colour; the upper surface deep brown, inclining to greyish, and the under parts dingy white, barred with deep brown. It is said to derive its name from the partiality it shows for bees, wasps, and their larvæ as food. The honey-buzzard inhabits Russia, Sweden, and Norway, and is found generally in the south of Europe. It is rare in this country, though it has been known to breed here.

BYRRHUS, *bir'-rus*, a genus of the order *Coleoptera*. This insect is about the size of the lady-bird, is of a deep brown colour, with its wing-shells marked by black lines. It is commonly found in gardens.

BYRSONIMA, *bir-so-ni'-ma*, a genus of plants belonging to the natural order *Malpighiaceæ*, consisting of tropical trees, all remarkable for their astringency. Thus the bark of *B. crassifolia* is used internally as an antidote to the bite of the rattlesnake, and for other purposes where an astringent medicine is desirable. The barks of other species are much employed in Brazil for tanning. Several species have edible fruits. The fruit of *B. spicata* is used medicinally in the treatment of dysentery.

BYSSOLITE, *bis'-so-lite* (Gr., *bussos*, fine flax, *klados*, a branch), a name applied to fibrous varieties of amianthus, tremolite, actinolite, and other minerals of a filamentous nature.

BYSSUS, *bis'-sus* (Gr., *bussos*), the silky filament by which molluscs with bivalve shells attach themselves to rocks or other fixed substances.

In Botany, a name given to some of the lowest and most obscure forms of vegetation, sometimes ranked among *algæ*, sometimes among *fungi*.

BYTTNERIACEÆ, *bit'-ne-ri-ai'-se-e* (in honour of A. S. Buttner, a professor at Gottingen), the Chocolate family, a natural order of dicotyledonous plants in the sub-class *Thalamifloræ*—trees, shrubs, or undershrubs, sometimes climbing. There are 45 genera and 400 species, mostly tropical plants. In their properties they closely resemble the *Malvaceæ* and *Sterculiaceæ*; thus, many are mucilaginous, as the *Waltheria douradinha*, the species of *Pterospermums*, and the bark of *Guazuma ulmifolia*, *Abroma angustum*, and *Donbeya spectabilis*. The fruit of *Guazuma ulmifolia* contains a sweetish pulp, which is eaten in Brazil. The most important plant of the order is *Theobroma Cacao*, the cacao or cocoa-tree, from the seeds of which cocoa and chocolate are prepared. (*See* THEOBROMA.) The typical genus *Byttneria* does not include any plants remarkable for useful products.

C.

CAAING WHALE, *ka'-ing* (*Globicephalus deductor*), known also as the Black Whale, the Howling Whale, the Social Whale, and the Pilot Fish, a species of whale found in the northern seas between the Orkney Islands and Iceland, and also on the Scandinavian coasts. By some naturalists it was formerly included in the genus *Delphinus*, with dolphins and porpoises, but it is now regarded as a distinct genus, characterized by the rounded top of the head and rounded muzzle. In appearance it is not unlike a common porpoise, but it is far larger, being from 16 to 25 feet in length. The body is thick, sometimes 11 feet, and tapers to the tail, which is deeply forked. The breast-fins, or arms, are long and narrow, sometimes reaching as long as 6 feet, and in this peculiarity the Caaing differs from every other whale. The skin is black in colour and is beautifully smooth and shiny. The under part has a white strength running throughout its full length. Its food consists of large fish such as cod and ling, but it also feeds on mollusca, and particularly on the cuttle fish. It is very gregarious, and immense shoals are seen in the northern seas.

CABBAGE, *kab'-baj*. (*See* BRASSICA.)

Cabbage Bark. (*See* ANDIRA.)

Cabbage Butterfly, a common name for several species of butterfly, the larvæ of which devour the leaves of plants of the cabbage tribe, and are popularly known as cabbage-worms or kale-worms. The well-known white garden butterflies are of this kind. The excessive multiplication of these insects is generally prevented by small birds, which devour them and the caterpillars.

Cabbage Moth (*Noctica brassicæ*), a species of moth, the caterpillar of which (greenish-brown in colour) is sometimes very destructive. The perfect insect is very handsome, of a rich brown colour, the upper wings waved with darker brown and with pale and white spots. The fringe of the wings is dotted with black and ochre.

Cabbage-Fly (*Anthomyia Brassicæ*), an insect of the same genus as the house-fly, beet-fly, and turnip-fly. Its larvæ feed upon the roots of cabbage, and often do great injury. It is about a quarter of an inch long, and the expanse of its wings is about half-an-inch. The colour of the male and female is dark grey. The larvæ, which are yellowish-white in colour, closely resemble those of the common flesh-fly.

CABBAGE PALM, OR CABBAGE TREE, a name commonly given to various palms in various countries having a tender terminal bud, which is boiled and eaten as a vegetable, thus the Cabbage Palm of the West Indies is *Areca oleracea*, and of the southern states of America the Palmetto. (*See* ARECA, CHAMÆROPS, EUTERPE, PALMETTO.)

CABOMBACEÆ, *kai-bom-bai'-se-e*, the Water-shield family, a natural order of plants in the class *Dicotyledones*, sub-class *Thalamifloræ*—aquatic plants with floating peltate leaves. There are only two genera belonging to the order: namely, *Cabomba* and *Hydropeltis*. The species occur in America, Australia, and India; they have no important properties. *Hydropeltis purpurea* is said to be nutritious.

CACAO, OR COCOA. (*See* THEOBROMA.)

CACHALONG, OR CACHOLONG, *kash'-a-long*, a fine variety of opal, found on the borders of the river Cach, in Bucharia. (*See* OPAL.) A specimen from the Faroe Islands consisted of silica 95·32, water 3·47, and traces of iron, potash, soda, lime, and magnesia. It is sometimes called Pearl Opal.

CACHALOT. (*See* SPERM WHALE.)

CACHEXIA, *kak-ex'-i-a* (Gr., *kakos*, bad, *hexis*, habit), a term used in Medicine to denote a group of diseases, and also the bad condition of body accompanying any particular disease: thus, cancerous cachexia and gouty cachexia express the peculiar state of body when cancer or gout is developed, as opposed to a mere local attack. It is employed by Cullen to denote a particular class of diseases in which the general habit is affected; and a change of complexion, with emaciation or morbid enlargement, are characteristic symptoms; as, jaundice, dropsy, &c.

CACTACEÆ, OR CACTEÆ, *kak-tai'-se-e*, the Cactus or Indian Fig family, a natural order of plants belonging to the class *Dicotyledones* and the sub-class *Calycifloræ*. The *Cactaceæ* are remarkable for their succulence, for the great development of their cellular tissue, and the anomalous forms of their stems, which are globular, columnar, flattened, or angular. Most of the species are leafless, having tufts of hairs or spines instead of leaves. The flowers are sessile, sometimes very showy; the sepals and petals are usually numerous, and scarcely distinguishable from each other. The stamens originate in the orifice of the tube formed by the combination of the petals and sepals, are very numerous, and consist of delicate thread-like filaments terminated by small roundish anthers. The ovary, which, in consequence of its adhesion to the sepals, seems to occupy the place of the flower-stalk, consists of a single cell lined with parietal placentas, covered over with minute ovules; its style is slender, with stigmas equal in number to the placentas. The fruit is succulent, and contains a great number of seeds, which are without albumen. These plants are, without exception, natives of the tropical regions of America. There are 18 genera and about 800 supposed species. Many yield edible fruit, useful in febrile complaints. Some grow on high mountains reaching even to the snow line, and some thrive well on old lavas, splitting them by their penetrating roots, and thus preparing the soil for other plants. Their organisation well adapts them for the endurance of great heat and long droughts; their tough skin enables them to resist the action of a dry atmosphere and scorching sunshine, while their method of growing is to thrive vigorously for a few months, and then rest for the remainder of the year, having stored up sufficient moisture in their succulent stems. They are a great boon to the districts in which they abound, in consequence of thus containing a store of wholesome juice. Cattle feed on the succulent stems of some species during the dry season in certain districts of South America. One plant belonging to the order is largely cultivated in Mexico for the nourishment of the cochineal insect; and numerous species are grown in European conservatories on account of their splendid flowers, or their singular forms. Most of them are easily propagated by taking off branches, drying them a little, and then planting them; but the horticulturist must follow the normal conditions of their growth by watering freely for a few months, and then almost entirely withholding moisture for the remainder of the year. The most interesting species are described under the names of the genera to which they belong. (*See* CEREUS, ECHINOCACTUS, MELOCACTUS, OPUNTIA, PERESKIA.)

CACTUS, *kak'-tus* (Gr., *kaktos*, a prickly plant), the name under which Linnæus included the *Cactaceæ*, believing that they formed a single genus. The name still continues in popular use, being applied to any plant in the order. (*See* CACTACEÆ.) The term appears to have been adopted from Theophrastus, who used it to describe a spiny plant.

CADDICE WORM, OR CADDICE FLY, *kad'-dis*, the common name of the species of *Phryganea*, the larvæ of which, the well-known Cad-bait or Caddice worms of anglers, reside in the water in cases, which they form of various substances, such as bits of stick, grains of seed, small stones, &c., held together by a silken thread, secreted in their bodies in the same manner as in the silkworm. The perfect insect, the caddice-fly (*Phryganea grandis*), has a body of a leathery consistence, and thickly clothed with hair; head small, with semi-globular eyes; antennæ as long as the body; anterior wings elongated lanceolate in the females, but rather more obtuse in the males. They are very active, moving with a gliding motion; but their flight is awkward. They frequent damp and marshy situations. When handled, they emit a very unpleasant odour. Their colours are ordinarily brown or grey.

Nearly 200 species have been described in Britain alone.

CADELLE, *ka-del'* (*Trogosita Mauritanica* or *Caraboides*), an insect of the family *Xylophagi*, order *Coleoptera*, section *Tetramera*. It is sometimes found in granaries in Britain, but apparently imported from southern continental countries where its larvæ commit great ravages on stored corn, bread, almonds, &c. The larvæ are about ¾-inch long, flat, fleshy, rough, and white. The perfect insect is a glossy, chestnut-coloured beetle.

CADMIA, *kad'-me-a*, a term applied to the incrustation found in zinc furnaces and so called because it contains about 15 or 20 per cent. of the metallic element cadmium.

CADMIUM, *kad'-me-um* (symbol Cd, atomic weight 56, specific gravity 8·6). A soft white metal, with a slightly bluish tinge found usually in combination with zinc and discovered independently by Stromoyer and Hermann, in 1817. It was first found in small quantities in certain zinc ores, in consequence of the behaviour of their solutions with sulphuretted hydrogen. It is occasionally found in nature as a sulphide in zinc ores, and is obtained as an accidental product during the extraction of that metal. Being much more volatile than zinc, the first portions of the distilled metal contain a large proportion of cadmium. It is separated from the zinc by means of sulphuretted hydrogen. It much resembles tin in its physical properties, being soft, malleable, and ductile, and when bent emits a creaking sound, like tin. It is easily fused, and distils at a high temperature. When heated in air, it oxidizes more readily than zinc, burning with a luminous flame, and producing a reddish-brown oxide. It fuses at 442° Fah., and rises in vapour at 600°; by slow cooling it may be obtained in beautiful octahedral crystals. When heated in dilute hydrochloric or sulphuric acid, it evolves hydrogen. The protoxide is one of the principal compounds. In the former state it is obtained when cadmium is ignited or heated in air. It is yellow, brown, or black, according to the temperature to which it has been exposed. It is infusible, does not volatilize, and forms well-marked salts with the acids. In the latter state it is a white precipitate obtained by adding an alkali to a solution of a cadmium salt. The *chloride* is formed by dissolving the metal in hydrochloric acid. It crystallizes in four-sided prisms. The *sulphide* occurs in nature as the mineral greenockite, and may be artificially obtained by heating a mixture of oxide of cadmium and sulphur, is much used as a pigment under the name of cadmium yellow. It is of a bright yellow colour, but becomes temporarily red on being heated. The iodide of cadmium has of late received an important application in photography. Being a very stable salt, it is not decomposed when added to collodion. For this reason, collodion iodized with it preserves its sensitiveness undiminished during many months.

CADUCOUS, *ka-du'-kus* (probably from *caduc*, fleeting, frail), falling early or soon after development. Thus, a calyx is said to be *caducous* when it falls off before the flower expands, as in the poppy.

CÆCILIA, *se-sil'-ia* (Latin, *cæcus*, blind), a genus of reptiles with very small, imperfect or blind eyes, hence the name. They inhabit warm countries and marshy places. Formerly they were placed among the serpents, on account of their shape, but by reason of their anatomical structure (the vertebræ being articulated as in fishes), and of the fact that they are found to breathe by gills when young, and afterwards undergo metamorphosis, they are now classed with the *Batrachia*. The body is worm-like, the head small, the skin viscous, smooth, and annularly wrinkled, apparently uncovered, but upon dissection minute scales are discovered on some species, if not all, between the wrinkles. The genus has been sub-divided, and now forms the family *Cæciliadæ*.

CÆCUM, *se'-kum* (Latin, *cæcus*, blind), a sac or tube having a closed end connected with the intestines of any animal. In man there is but one, and is apparently of but little use, if any. It is situated at the end of the small intestine, and terminating at the commencement of the large intestine. (*See* INTESTINES.) In many of the mammalia, however, it is large, and secretes an acid juice to aid perfect digestion. Birds have two cæca.

CAEN STONE, *kan(g)*, an oolitic limestone, so termed from its being extensively quarried in the neighbourhood of Caen, in Normandy. It is the French representative of our *Great* or *Bath oolite*. It forms an admirable building-stone; for though it is soft in the quarry, it hardens on exposure, and is found to be exceedingly durable.

CÆSALPINIA, *se-zal-pin'-i-a* (so named in honour of Cæsalpinius, a Romish physician of the 16th century), a genus of plants belonging to the natural order *Leguminosæ*, being the type of the sub-order *Cæsalpineæ*. The species are trees or shrubs, natives of the warm parts of America and Asia, having pinnate or bipinnate leaves, showy yellow flowers, and stems which are usually more or less prickly. The useful products of the genus, especially dye stuffs, are very numerous. The twisted ligumes of *C. coriaria* are powerfully astringent, and are extensively used in tanning. In commerce they are known as Divi-divi, or Libi-dibi pods. The legumes of *C. Papai*, the Pi-pi of commerce, are employed for similar purposes, but they are very inferior to them.

CÆSALPINIEÆ, *se-zal-pin'-e-e*, a sub-order of the *Leguminosæ*, or Bean family, characterized by irregular flowers, which are not papilionaceous, and by the petals being imbricated in the bud, with the upper or odd petal inside the lateral ones. The genera belong to the warm regions of the globe, and some of the species—the locust-trees, for example—grow to a prodigious size.

CÆSIUM, *sees'-i-um* (Latin, bluish), a rare alkaline metal, found in some mineral waters by Bunsen, in 1861, by means of the spectrum analysis.

CAFFEINE, OR THEINE, *kaf-feen'*, a white crystalline alkaloid found in tea, coffee, Paraguay tea, and in *guarana*, a species of chocolate prepared from the fruit of the *Paullinia sorbites*. Tea contains from 2 to 6 per cent. of caffeine, coffee but 1 per cent. It is easily obtained from tea by making a strong infusion of the leaves, mixing it with subacetate of lead, which precipitates the tannin, and transmitting a current of sulphuretted hydrogen through the liquid to precipitate the excess of lead. On evaporating the solution, and allowing it to cool, the caffeine crystallizes out in long silky needles. It has a weak, bitter taste, and fuses at 352° Fah. and sublimes without decomposition at a higher temperature, cold water and alcohol dissolve but a small quantity; but it is very soluble in boiling water and ether.

CAFFRES, OR KAFFIRS. (*See* ETHNOLOGY.)

CAFFRE-BREAD. (*See* ENCEPHALARTOS.)

CAINOZOIC, *kain-o-zo'-ik* (Gr., *kainos*, recent, *zoe*, life), a term applied to the upper stratified systems holding recent forms of life, as distinguished from *Mesozoic* (holding intermediate), and *Paleozoic* (holding ancient and extinct forms). The cainozoic period embraces the tertiary and post-tertiary systems of British geologists. (*See* GEOLOGY.)

CAIRNGORM, OR CAIRNGORUM, *kairn'-gorm*, a smoky-tinted variety of quartz, often of a fine brown or amber colour. It receives its name from the mountain Cairngorm in Aberdeenshire, on the sides of which it is found in great perfection. It is sometimes so dark as to be nearly black. It is much used for seals, brooches, and the larger forms of jewellery; and one Edinburgh lapidary is said to have cut nearly £400 worth from a single crystal. The brown coloured is frequently called smoky quartz, and the amber variety, which is sometimes nearly yellow, is spoken of as topaz.

CAITHNESS FLAGS, *kaith-ness'*, a series of dark-coloured flaggy beds, belonging to the middle portion of the Old Red Sandstone, as developed in Scotland. These beds are rich in fossil fishes. The stone is of great toughness and durability, and is largely employed for paving.

CAJANUS, *kaj'-a-nus* (from the Malay name *Catjang*), a genus of plants belonging to the natural order *Leguminosæ*, sub-order *Papilionaceæ*. The species yield a kind of pulse, known as pigeon-peas, much used for food by the poor of the West Indies. In Jamaica, pigeons are usually fed with these seeds; hence their English name.

CAJEPUT. (*See* MELALEUCA.)

CALABAR BEAN, *kal'-a-bar*, the seed of *Physostigma venenosum*, a twining plant of the natural order *Leguminosæ*, somewhat similar to the kidney bean. It is a very powerful poison, but very small doses of the powder or extract are found to be valuable in teranus, paralysis, and other diseases of the nervous system. When placed on the eyeball, a remarkable effect of contraction is produced, of which eye-doctors avail themselves.

CALABASH TREE. (*See* CRESCENTIA.)

CALABASH NUTMEG. (*See* MONODORA.)

CALADIUM, *kal-ai'-di-um*, a genus of plants belonging to the natural order *Araceæ*. The species are mostly natives of South America and the West Indies, and are frequently cultivated as stove-plants in this country for the sake of their elegant spotted stems and neat leaves. They have the same general appearance as the species of *Arum*, and resemble them in being all more or less acrid. The species *C. seguinum* is highly poisonous, and when any part is chewed, the tongue swells so much that the power of speech is lost. On this account, it has received the popular name of dumb-cane. *C. sagittifolium*, the Brazil cabbage, is cultivated in many parts of the world for its leaves and root-stock, which, when boiled, are edible. The leaves are preferred, and are said to form a most nutritious and delicate vegetable. The corms of many other species, when cooked, are edible.

CALAMANDER-WOOD. (*See* DIOSPYROS.)

CALAMARY, *kal'-a-ma-re*, squid, or sleeve fish, a genus of cephalopodous mollusks, the various species of which are distributed all over the world. The body contains an internal shell shaped like a pen, and the mouth is furnished with eight arms. Like the cuttle fish, they have the power of diffusing a dark-coloured liquid around them in the water. The common calmary, popularly known as the squid, grows to nearly $1\frac{1}{2}$ feet in length, and is of a bluish colour speckled with purple. (*See* also CEPHALOPODA.)

CALAMINE, *kal'-a-mine*, a carbonate of zinc, found in various parts of America in rhombic prisms and in massive incrusted aggregations. It is an important ore of zinc. (*See* ZINC.)

CALAMINTHA, *kal-a-min'-tha* (Gr., *kalos*, beautiful, *mintha*, mint), a genus of plants belonging to the natural order *Labiatæ*. Four species are natives of Britain, and are known respectively by the names of mountain-balm, cat-mint, basil-balm, and wild basil. The first, which is also termed the common calamint (*C. officinalis*), has aromatic leaves, which are frequently employed by country peoply to make herb-tea, and as a pectoral medicine.

CALAMITES, *kal'-a-mites* (Lat., *calamus*, a reed), fossil stems occurring abundantly in the coal-measures, where about 40 species have already been discovered. They are hollow-jointed cylinders, with longitudinal furrows, and their flattened condition proves that they must have been so soft as to offer little resistance to pressure. Hooker supposes them to be allied to Ferns or Club-mosses.

CALAMUS, *kal'-a-mus* (Lat., from Gr., *kalamos*, a stalk, stem, or reed), a pen made from a reed, probably the stem of *Arundo Donax*, used by the ancients. The best were obtained from Egypt. The stem was softened, dried, and then cut as quill pens are now cut. The reed-pen, called *Kalâm* by the Arabs, is still commonly employed in Oriental countries.

CALAMUS, a genus of palms consisting of numerous species, all having very slender stems, which are found climbing over the trees in the forests of the hotter parts of the East Indies. Some of the best descriptions of walking-canes are obtained from the plants of this genus. The Malacca cane is the produce of *C. Zalacca*; Rattan cane, of *C. scipionum* and *rudentum*; and Partridge cane, of an undetermined species. The fruit of *C. Draco* is the chief source of the astringent resinous substance known in commerce as dragon's blood. This completely covers the fruit, and is melted or scraped off, and then formed into small cakes.

CALAMUS AROMATICUS, *a-ro-mat'-i-kus*, a name given by the ancients to a plant to which special medicinal virtues were ascribed, perhaps the lemon-grass of India. "Sweet calamus" is mentioned in the book of Exodus.

CALAMUS SCRIPTORIUS, *scrip-to'-ri-us* (Lat., a writing-pen), in Anatomy, is a groove or canal with a pen-like termination at the bottom of the fourth ventricle of the brain.

CALANDRA, *kal-an'-dra*, a genus of coleopterous insects closely allied to the *Circulionidæ*. The corn-weevil (*C. granaria*) is included in this genus. In its perfect form this little beetle is of a reddish-brown colour, about an eighth of an inch long; has a slender snout slightly bent downwards, a closely-punctured and very long thorax, and furrowed wing-covers, that do not entirely cover the tip of the abdomen. It bores a hole into the grain with its proboscis, in which an egg is deposited. It will afford some idea of the formidable character of these tiny beetles, to state as an ascertained fact that one female is capable of producing six thousand of her kind in a single year.

CALAPPA, OR BOX-CRAB, *kai-lap'-pa*, a genus of *Crustacea* inhabiting the seas of the Indian Archipelago, the Pacific and Atlantic oceans, and the seas of South America. One of this family (*Calappa granulata*) is an inhabitant of the Mediterranean, and found frequently in the fissures of rocks, at a depth sometimes of a thousand feet. Their general colour is pale rose, with whitish feet and brown nails.

CALASAYA BARK. (*See* CINCHONA.)

CALATHUS, *kal'-a-thus*, a genus of coleopterous insects belonging to the *Geodephaga* section. Upwards of twenty of this species of ground-beetle are found in Europe.

CALCAIRE-GROSSIER, *kal-kaire gros'-se-ai* (Fr., coarse limestone), an important member of the Eocene group of beds in the Paris basin, usually co-ordinated with the Barton, Bagshot, and Bracklesham beds of England. The fossils found in it are very abundant, and at one spot at least 400 different species have been discovered. They consist of fresh water and marine mollusca. *Calcaire-Silicieux*, *sil-e-se-u(r)* (Fr., flinty limestone), a compact silicious limestone, which sometimes takes the place of the *Calcairegrossier* in the Paris basin.

CALCAREOUS, *kal'-ka-re-us*, a term applied to any substance containing much lime.

Calcareous Spar. (*See* CALCITE.)

Calcareous Tufa, *kal-kai'-ri-us tu'-fa*. —Calcareous tufa is formed in volcanic districts by the deposition of calcareous matter in a more or less compact form.

Calcareous Waters.—Waters which hold in solution much carbonate or sulphate of lime or both. They are frequently known as hard waters, and when heated in a bottle, or other vessel, deposit some of their lime in white masses around its sides. In the high temperature the carbonic acid escapes, leaving behind a crystalline deposit of carbonate of lime. In nature enormous crystalline concretions are formed by water charged with carbonic acid percolating through calcareous strata. The stalactite caverns of Derbyshire are instances of this. (*See* STALACTITES, STALAGMITES.)

CALCEDONY, OR CHALCEDONY, *kal-sed'-o-ne* (from Calcedon, in Bithynia), a translucent massive variety of quartz, closely allied to opal and agate and often found associated with them. It often occurs in cavities in amygdaloid and other rocks in the form of "icicles," or stalactites. The colours vary from white to yellowish-brown, pale grey, bluish grey, and light brown.

CALCEOLA, *kal-se-o'-la* (Latin, a little shoe), a fossil brachiopod, so called from its under valve, which is shaped like the point of a shoe, and fitted with a lid-like upper valve. It is characteristic of the middle Devonian period.

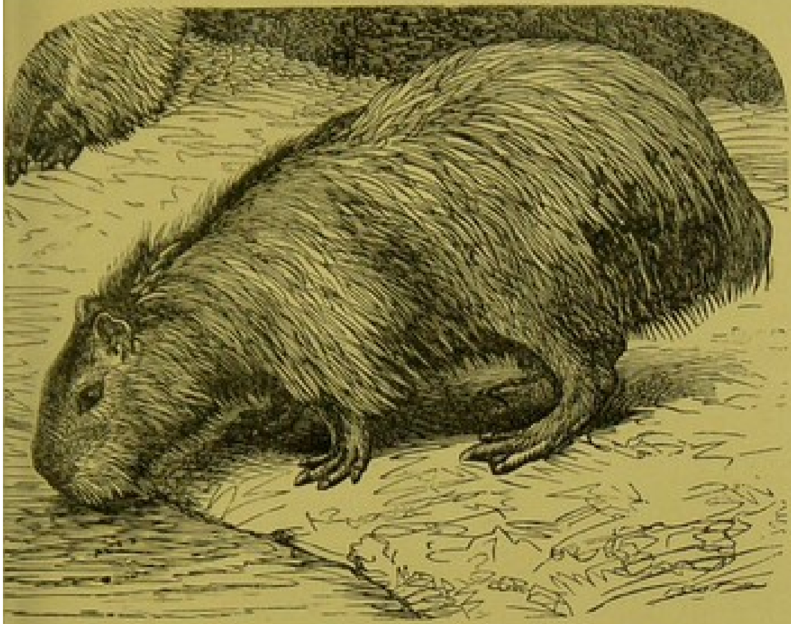
CALCEOLARIA, *kal-se-o-lai'-re-a* (Latin, *calceola*, a little shoe), a genus of herbaceous or shrubby plants belonging to the natural order *Scrophulariaceæ*. The species are natives of South America and the Falkland Islands. In Chili and Peru they occur in such abundance as to give a peculiar aspect to the landscape. Most of them have corymbs of showy flowers, generally yellow, but sometimes purple. Calceolarias are extensively cultivated in Europe as greenhouse plants, and by crossing the species some beautiful hybrids have been produced. Some of the species are used in South America for dyeing.

CALCINE, *kal-sine'* (Latin, *calx*, lime), a chemical term, signifying the separation of the more volatile portions of a solid body by means of heat. Thus lime is formed of chalk or limestone by calcination. The older chemists applied the term to the oxidation of metals by heat, thinking it was an analogous process to that just mentioned; they therefore called all oxides produced by heat, calx, or calces of the metal; thus, calyx of tin is what is now called oxide of tin.

CALCINITES, *kal'-sin-ites*, compact calcareous incrustations formed in the open air. A section shows layers and lines of varying colour and hardness, which mark the gradual progress of the deposit.

CALCITE, CALCAREOUS SPAR, OR CARBONATE OF LIME, *kal-site'*, native crystallized carbonate of lime, occurring under nearly 600 different crystalline forms, all derived from the fundamental rhombohedron. It is one of the most abundant of all minerals, and occurs in all geological formations. The purest crystals are transparent and colourless; other varieties are semi-transparent and opaque, often coloured with grey, red, yellow, rose, and violet. When crystallised in hexagonal and square prisms, it is known as arrogonite. One transparent form occurring in rhombohedral crystals possesses the property of double refraction—*i.e.*, objects seen through it appear double. From having been found in Iceland, it is called Iceland Spar (which *see*).

CALCIUM, *kal'-se-um*, the metallic base of the alkaline earth lime. Calcium belongs to the second group of metals, and is one of the most abundant substances in nature, forming a very large portion of the crust of the earth. It occurs in nature in combination with fluorine as fluor spar, with oxygen and carbonic acid as chalk, limestone, and marble, and with oxygen and sulphuric acid as gypsum, which is hydrated sulphate of lime. Calcium was first obtained by Sir Humphrey Davy by electrolysis, in 1808; but little was known of its properties until Dr. Matthiessen formed it by the electrolytic decomposition of a mixture of the chlorides of calcium and strontium. It is a light-yellow metal of the colour of gold when alloyed with silver, and as hard as gold, very ductile and malleable. It rapidly decomposes water, tarnishes in a day or two even in dry air, and in moister air it becomes slowly oxidized. It burns with a brilliant flash when heated in air, chlorine, or the vapours of iodine, bromine, and sulphur, and rapidly decomposes even at ordinary temperatures. It has also been obtained by acting on iodide of calcium with



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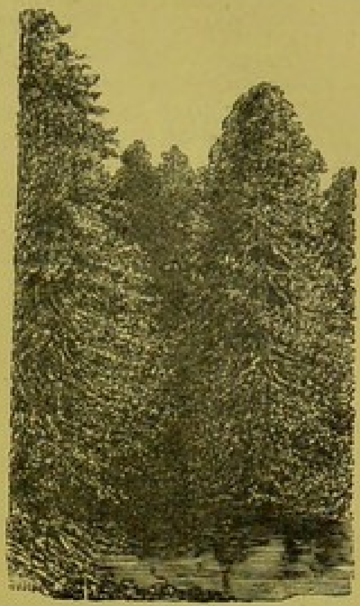

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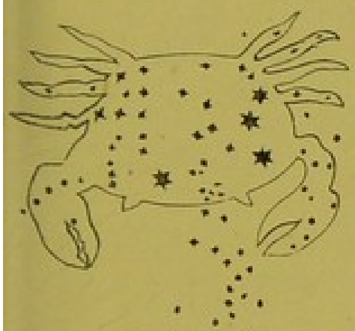
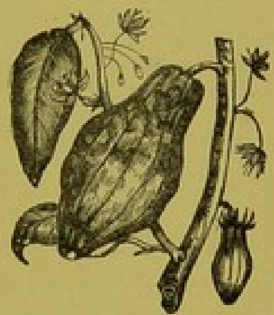
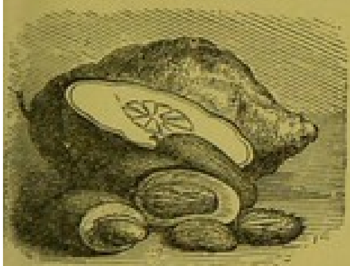


CANCER (ZODIAC).

CRANE.



COCOA-BEAN.



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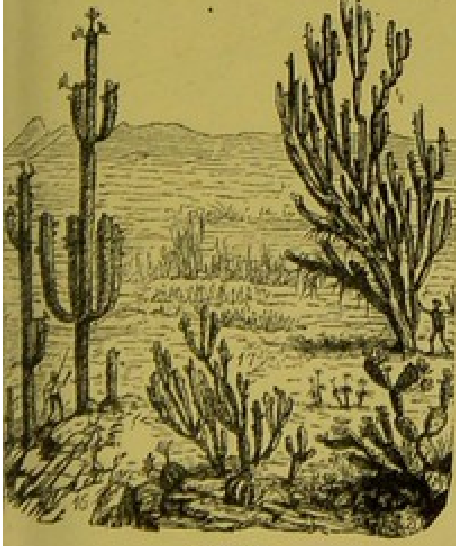


CACTUS.

CARACAL.

sodium. The best-known compound of calcium is its oxide or lime (Ca_2O). (*See* LIME.)

Chloride of.—Chloride of calcium may be obtained from the residue remaining in the retort after the preparation of ammonia, by adding to it a slight excess of hydrochloric acid and evaporating. On cooling, the solution deposits crystals containing six atoms of water of crystallization. These crystals, which are six-sided prisms, are highly deliquescent. By fusing at a heat not exceeding 302° Fah., four equivalents of water are expelled, and the remaining white porous mass is extremely useful in the laboratory for drying gases.

Fluoride of.—Fluoride of calcium occurs somewhat abundantly in the mineral kingdom as fluor spar, which is generally associated with the ores of tin, lead, copper, and zinc. It is found in crystals, the primitive form of which is the cube. They are generally yellow or purple, and sometimes pale green, or even colourless. On being heated, they decussitate violently, and emit a peculiar bluish-green phosphorescent light, which is probably due to electricity. Fluoride of calcium is principally used in the laboratory for this latter purpose. It is also employed as a flux in copper-smelting.

Phosphide of.—Phosphorus and calcium unite to form this compound, which is interesting as the source of the phosphides of hydrogen. It is prepared by distilling phosphorus over lime heated to low redness, a mixture of phosphide of lime and phosphate of calcium being the result. Phosphide of calcium is a dull red substance, hard enough to strike fire with steel. When powdered and exposed to the air, it slacks, emitting phosphuretted hydrogen.

Sulphides of.—There are several compounds of calcium with sulphur, the principal of which are the protosulphide, which is known by the name of Canton's phosphorus, and the pentasulphide.

Teroxide of.—This compound was procured by Thénard in brilliant crystalline plates, by adding lime-water to peroxide of hydrogen.

CALCULUS, *kal-ku-lus* (Lat., dim. from *calx*, a limestone), a hard inorganic concretion formed in various parts of the animal body, and bearing a general resemblance in form or composition to stone. It receives various names, from the parts in which it exists; as, *salivary* in the salivary glands and ducts, *pulmonary* in the lungs, *intestinal* in the stomach or intestinal canal, *biliary* in the gall-bladder, *urinary* in the kidneys or bladder, *gouty* in the joints of gouty persons. The most familiar instance of the formation of calculus is the tartar which is deposited from the saliva and mucus of the mouth upon the teeth. The term calculus is, however, most frequently applied to those concretions which are formed in the gall-bladder or biliary ducts, and those formed in the kidneys or bladder. *Biliary calculi*, or *gall-stones*, are composed almost entirely of cholesterine, with some colouring matter. They vary greatly in size and number, amounting sometimes to hundreds, and even, it is said, to thousands; but so long as they remain in the bladder they do not usually cause much uneasiness. It is when they pass into the canal by which the bile is conveyed to the duodenum, that they occasion great pain and derangement of the system. The pain occurs in paroxysms, and is generally attended with shivering and vomiting. If the bile be wholly obstructed, jaundice comes on, and rapid emaciation succeeds. The disorder sometimes proves fatal, but generally the stones find their way, sooner or later, into the intestines and the disturbance subsides. Hot applications over the seat of pain, or a warm bath, may be applied with advantage. *Urinary calculi, gravel, or stone in the bladder*, are concretions formed and existing in the urinary passages. They generally originate in the kidneys, and afterwards pass down into the bladder, where they frequently attain a very large size: some have been found to attain a weight of 14 to 16 oz., and even more. While in the kidneys they are termed *renal calculi*, and they sometimes remain there permanently, and may even attain a considerable size without causing much inconvenience; but they may also produce inflammation and abscess, and ultimately cause death. Generally, however, while yet of small size, they pass down the ureters into the bladder. Sometimes the passing is attended with symptoms similar to those occasioned by the passing of a gall-stone, and similar remedies are to be had recourse to. The calculus having passed into the bladder, is then termed a *vesical calculus*. At first, it is attended with comparatively little pain; but unless removed or evacuated, it is sure to enlarge, and to give rise to one of the most dreadful diseases that can afflict humanity. In the earlier stages much may be done to check the progress of this dangerous malady; but when the calculus is once formed, the only means by which it can be got rid of is an operation. The stone must either be withdrawn through the urethra by an instrument, or it must be broken into fragments small enough to be voided with the urine, or it must be extracted by an incision. (*See* LITHOTRITY, LITHOTOMY.) Many of the calculi, and, indeed, most of them, are not of one uniform composition, but consist of strata of two or three varieties, one forming a nucleus for the other deposits, and culculi thus formed receiving the name of *alternating*. Uric acid is more common as a nucleus than any other substance. Urinary calculus is more frequent in some districts than others, and locality likewise influences the species of the stone. It is much more common among males than females. The predisposing causes of it, however, are still very imperfectly understood.

CALCULUS, is a term generally applied to signify any branch of mathematics which may lead to or involve calculation—in fact, to all except pure geometry. There is the common *arithmetical* caiculus, and there is the *algebraic* calculus. The invention of the *infinitesimal* calculus (sometimes called the transcendental analysis), which involves the *differential* calculus and the *integral* calculus is claimed for Leibnitz; they are identical with the *fluxionary* calculus invented by Newton. The calculus of *partial differences* is a branch of the differential and integral calculus; and the calculus of *variations* is another portion of the same theory. That part of Algebra which relates to exponents and logarithms is sometimes called the *exponential* calculus.

CALEDONITE, *kal-e'-do-nite* (from Caledonia, Scotland), a compound of sulphate of lead with the carbonates of copper and lead, found in long prismatic crystals, of a deep bluish-green colour, at the Leadhills mine, in Scotland.

CALENDULA, *kal-en'-du-la*, the Marigold, a genus of plants belonging to the natural order *Compositæ*, sub-order *Tubilifloræ*. The species *C. officinalis* is the common marigold of English gardens, the gold-blume of the Germans, the *souci du jardin* of the French, and the furrancio of the Italians. Formerly, many medicinal virtues were ascribed to this plant, and its flowers were usually added to soups to colour them, and also to act as "comforters of the heart and spirits." Saffron is frequently adulterated with the yellow florets of the marigold. The name is stated to be derived from *calendulæ*, the Latin for the first day of the month, there being flowers almost any month in the year.

CALENTURE, *kal'-en-ture* (Lat., *caleo*, I make hot), is a term derived from the Spanish, and applied to a violent ardent fever common among sailors in very hot climates. It is so called either as being accompanied by a burning heat, or as resulting from the great heat of the climate.

CALIGO, *kal'-e-go* (Lat., darkness), dimness or obscurity of vision; it forms part of the name of various diseases of the eye attended with dimness or loss of sight; as *caligo corneæ, lentis, humorum*, &c. (*See* BLINDNESS, EYE.)

CALITRICHACEÆ, *kal-it-ri-kai'-se-e* (Gr., *kalos*, beautiful, *thrix*, hair), the Starwort family, a natural order of dicotyledonous plants, in the sub-class *Monochlamydeæ*. The species are small aquatic herbs. *Calitriche* is the only genus, and includes six species, natives of fresh-water pools in Europe and North America. Their uses are unknown.

CALLA, *kal'-la* (from Gr., *kallos*, beauty), a genus of plants belonging to the natural order *Orontiaceæ*. The most interesting species is *C. palustris*, from the acrid rhizomes of which the Laplanders prepare a kind of bread, by a tedious process, which includes drying, washing (to remove the acrid juices), grinding, and baking.

CALLICHTHYS, *kal-lik'-this*, (Gr., *kalos*, beautiful, *ichthys*, a fish), a genus of fishes of the family *Siluridæ*, natives of South America and other warm climates. They are entirely covered by rows of narrow scaly plates, and the head is protected by a sort of helmet. When the streams or pools in which they dwell dry up, they make their way across the land, for considerable distances, to other pieces of water. They deposit their eggs in nests made of leaves.

CALLIDIUM, *kal-lid'-i-um* (Gr., *kallos*, beauty, *eidos*, form), small beetles, infesting houses, and very destructive to woodwork, especially of spruce and fir. One of this family (*Callidium bajulus*), a flattish, rusty-black insect, will, according to Messrs. Kirby and Spence, not only eat their way through the rafters of a house, but even bore through sheet-lead: fragments of lead having been found in their stomachs.

CALLIGONUM, *kal-ig'-o-num* (Gr., *kalos*, beauty, *gonia*, angle), a genus of plants belonging to the natural order *Polygonaceæ*, characterised by a quadrangular fruit, winged at the angles. The species *C. Pallasia*, which is found on the sandy steppes near the Caspian sea, is valued by the wandering Kalmucks for the acid juice of its fruit and shoots, which often serves to allay their thirst; and also for the nutritious gum which may be obtained from its root.

CALLITRIS, *kal'-e-tris*, a genus of coniferous plants, *C. quadrivalvis*, the arar-tree, yields the resin called sandarach, juniper resin, or gum-juniper, which is imported in large quantities from Mogadore. It is much employed in the preparation of varnishes. When powdered, it is called pounce. The timber furnished by this tree is very durable, and is used by the Turks for the floors and ceilings of their mosques.

CALLOSITY, *kal-os'-i-te* (Lat., *callositas*), is an induration or hardness of the skin; as that of the hands through hard labour. (*See* CORNS.)

CALLUNA, *kal-lu'-na*, (*See* HEATH.)

CALLUS, *kal'-us*, the bony matter which is deposited between the fractured ends of broken bones. It is an osseous substance, formed by a process of nature for the re-uniting of broken bones.

CALM, *kahm*, the name given to that state of complete rest in the air when there is no wind stirring. The regions in the immediate vicinity of the equator are the parts of the ocean where the mariner is overtaken by the most frequent and most durable calms. In the Atlantic Ocean the region of calms has a breadth of six degrees. The Pacific Ocean derives its name from being characterized by an equatorial belt of calm region averaging five degrees in breadth, and lying between the south-eastern and north-eastern trade-winds. (*See* TRADE-WINDS.) The calm latitudes of the Atlantic Ocean are situate between the tropic of Cancer to very nearly lat. 29° N. When a calm occurs unexpectedly, it is likely to be followed by a violent storm.

CALOMEL, *kal'-o-mel* (Gr., *kalos*, good, *melas*, black, from the qualities and colour of the Ethiop's mineral to which the name was originally applied), sub-chloride of mercury. (*See* MERCURY, CHLORIDE OF.)

CALOPHYLLUM, *kal-o-fil'-um* (Gr., *kalos*, beautiful, *phullon*, leaf), a genus of plants belonging to the natural order *Guttiferæ*, including many valuable timber trees. *C. angustifolium*, the piney-tree of Penang and the islands to the eastward of the Bay of Bengal, furnishes fine straight spars. *C. calaba* and *C. inophyllum*, besides yielding timber, produce seeds from which good burning oil is obtained. The fragrant resinous substance known as East-Indian tacamahaca is a product of the species of this genus.

CALOR MORDICANS, *kal'-or mor'-de-kans* (Lat., biting heat), is applied to a particular kind of heat that sometimes attends typhus and other fevers, and is considered a dangerous symptom. It is biting and pungent, rather than burning, and leaves a smarting sensation on the fingers for several minutes after touching it.

CALORIC. (*See* HEAT.)

CALOTROPIS, *ka-lot'-ro-pis* (Gr., *kalos*, beautiful, *tropis*, keel, in allusion to the keel of the flower), a genus of tropical plants belonging to the natural order *Asclepiadaceæ*. The species *C. gigantea* or *procera* yields the medicinal bark known as Mudar bark, which has been much employed in India for the treatment of cutaneous affections, and occasionally as a substitute for ipecacuanha. It contains a peculiar principle, called *mudarine*. The fibres of the bark are known under the names of *Ak* and *Mudar fibres*. The bark of the root of *C. Hamiltonii* has similar properties.

CALTHA, *kal'-tha* (Gr., *kalathos*, a goblet), a genus of plants belonging to the natural order *Ranunculaceæ*, tribe *Helleboreæ*. The species *C. palustris*, commonly known as the Marsh Marigold, grows wild in marshy places, and has showy bright yellow flowers.

CALUMBA, OR COLUMBO, *ka-lum'-ba*, the name given to a root very extensively used in medicine as a stomachic and mild tonic. It takes its name from Colombo, in Ceylon, whence it was first brought; but it is now obtained chiefly from the Mozambique. (*See* JATEORHIZA.)

CALX. (*See* LIME.)

CALYCANTHACEÆ, *kal-e-kan-thai'-se-e*, the *Calycanthus* family, a natural order of dicotyledonous plants in the sub-class *Calyciflorœ*. These are shrubby plants, greatly resembling the *Rosaceæ*, but they differ in having opposite leaves, and some other particulars. There are but two genera, *Calycanthus* and *Chimonanthus*, the species of which are natives of Japan and North America. The flowers have a peculiar aromatic fragrance. The bark of *C. Floridus*, the Carolina allspice, is sometimes used in the United States as a substitute for cinnamon-bark.

CALYCERACEÆ, *kal-e-se-rai'-se-e*, the *Calycera* family, a natural order of dicotyledonous plants in the sub-class *Corolliflorœ*. They are exclusively natives of South America, and hold an intermediate position between *Dipsaceœ* and *Compositœ*.

CALYCIFLORÆ, *kal-e-se-flor'-e*, a sub-class of *Dicotyledones*, comprising plants with flowers having the following general characters:—Calyx and corolla usually present, the petals of the latter being generally distinct, but sometimes slightly connected; stamens borne on the calyx, but free from the ovary, or else apparently seated on the ovary. The *Calyciflorœ* are subdivided into *Perigynœ* and *Epigynœ*. Fifty-one calyciforal orders are described by botanists.

CALYMENE, *kal-e-me'-ne* (Gr., *kekalumene*, concealed), a genus of trilobites, so named from the obscurity which long hung over the real nature of these fossil crustaceans. They belong to the Silurian system, and are particularly well represented in the Ludlow rocks. The most abundant species is *C. Blumenbachii*, which has long been known as the Dudley locust. (*See* TRILOBITE.)

CALYPTRÆA, *ka-lip-tre'-a* (Gr., *kalyptra*, a head-dress), a genus of gasteropodus mollusks, of the order *Pectini branchiata*, the shell is limpet-shaped, but the apex is more or less spiral. They are generally natives of warm climates, but two species are British. There are considerable varieties of shape as expressed in the common names given—cup and saucer limpets, bonnet limpets, slipper limpets, and chambered limpets.

CALYX, *kai'-liks* (Gr.), the external envelope of the flower. It is composed of modified leaves, called *sepals*, which are usually green. Within the whorl of sepals there is generally another whorl of leaves, called the corolla (which *see*), but sometimes the calyx is the only envelope of the parts of fructification. The calyx may either consist of a number of separate sepals, as in the poppy, buttercup, and wallflower, or these parts may be more or less united, as in the fuchsia, melon, and tobacco. In the former case, the calyx is termed *polysepalous* or *polyphyllous*; in the latter, *monosepalous* or *monophyllous*, or, more correctly, *gamosepalous* or *gamophllous*. Whatever be its colour, the external envelope must be considered as the calyx. The tube of the calyx sometimes adheres, more or less, to the ovary, as in the iris, gooseberry, currant, and in all plants of the Composite order. When such adhesion takes place, the calyx is said to be *adherent* or *superior*, because it appears to arise from the summit of the ovary. When there is no such adhesion, the ovary being quite distinct, as in the wallflower and buttercup, the calyx is described as *free*, *non-adherent*, or *inferior*.

CAMARA NUTMEG, *ka-ma'-ra*, a false or wild nutmeg, obtained from the *Acrodiclidium Camara*, a plant of the Laurel order, growing in Guiana. It is also known as the Ackawa nutmeg by the natives.

CAMASSIA, *ka-mas'-se-a* (from *quamash*, its native name), a genus of plants belonging to the native order *Liliàceœ*. The species *C. esculenta*, a native of North America, has edible roots. They are also known as biscuit-roots.

CAMBERWELL BEAUTY, the name given to a large and beautiful butterfly (*Vanessia Antiopa*), common in central and southern Europe, but rare in England. The wings are of a rich brown colour, of velvety appearance, with external bands of black and pale yellow, with large blue spots. The caterpillar feeds on the willow.

CAMBIUM, *kam'-be-um* (Latin, *cambio*, to change), a layer of vitally active cells placed on the outside of each annual zone of wood in an exogenous stem. It is from this that the new layers of wood are formed. The cambium-layer is dormant during the winter, at which time the bark is firmly attached to the wood beneath; but in spring it is in full activity, being charged with the elaborated sap of the plant; and then the bark may be separated from the wood beneath.

CAMBOGE. (*See* GAMBOGE.)

CAMBRIAN ROCKS, *kam'-bre-an*, a term applied by Professor Sedgwick to the lowest fossiliferous rocks, on account of their extensive development in North Wales, anciently called Cambria. The term is usually limited to a series of sandstones, gritstones, and slates, which underlie the Silurian Lingula strata. (*See* SILURIAN SYSTEM.)

CAMEL, *kam'-el* (Lat., *camelus*).—Of this genus of mammiferous ruminants there are two species—1, the common camel (*Camelus bactrianus*); 2, the Arabian camel or Dromedary (*Camelus Dromedarius*). The first is principally distinguished by its humps being two in number, whilst the dromedary has but a single hump. The latter species is distributed over an immense extent of country, being found in Arabia, Persia, Southern Tartary, Egypt, India, and the Canary Islands. The common camel is not nearly so abundant, and its geographical range much more limited. It is principally found north of the Taurus and the Himalaya Mountains. The camel is distinguished from all other ruminants, except the llama, by having incisor teeth. The upper jaw contains sixteen teeth—two incisors, two canines, and twelve molars; the lower jaw, six incisors, two canines, and ten molars—eighteen in all. The upper lip is swollen and divided, the nostrils slit obliquely, the neck elongated, the head long, the eyes very prominent, and the ears somewhat small. The legs of the camel are long, weak-looking members, terminating with two hoofs or toes, padded with soft cushions underneath, which enable the animal to walk securely on the soft sands of the desert. The stomach of the camel is a curious construction, and enables it to carry a supply of water wherewith it may refresh itself on its terribly long and tiresome journeys. The hump is composed of gelatinous fat, which, by re-absorption, furnishes the animal with sustenance when the nature of the country, or any other unfortunate contingency, deprives it of a supply of food. So well is the nature of the hump understood in the East, that the condition of the animal is judged of, and its improvement after a long journey measured by it. It is not uncommon to see camels come in after long and painful journeys with almost straight backs, the hump having almost entirely disappeared. Ordinarily a patient and rather stupid animal, the camel is sometimes very vicious and dangerous. The services of the camel to the wandering tribes of Arabs, and other inhabitants of the East, cannot be too highly appreciated, or, indeed, understood, by the people of civilized nations. The usual load of a caravan-camel (the Bactrian) is about five hundredweight; but, on extraordinary occasions, a strong camel will carry a thousand pounds! It will travel, so loaded, at the rate of nearly three miles an hour. The usual travelling speed of a caravan is eighteen miles a day. A dromedary will carry a rider a hundred miles in a day. Usually the camel produces only one young at a time, the average of the life of the animal is about thirty-five years. The flesh and milk of the camel are used as food by the Arabs. The only part of Europe in which this animal is found is at Pisa, in Tuscany. The date of the introduction of the camel into Europe is unknown. The usefulness of the camel as a beast of burden was not unknown to the ancients. In the Scriptures we frequently find allusions to the camel; the three thousand of these animals belonging to Job forming a considerable portion of his property. In the book of Genesis there are several notices of the camel, which would at least prove that this animal was a domesticated and useful servant of man four or five thousand years ago. The names of the camel in different countries are all very similar. The Hebrew name is gamal; it is the djemal of the Arabs; camelo of the Italians; in France, chameau; in Germany, kamel.

CAMELINA, *ka-me-li'-na*, the Gold-of-pleasure, a genus of cruciferous plants. *C. fœtida* is sometimes found growing in fields of corn and flax in Britain. *C. sativa*, which is a common field-plant in France, has seeds containing much fixed oil.

CAMELLIA, *ka-mel'-li-a* (in honour of George Joseph Camellus, a traveller in Asia), a genus of plants belonging to the natural order *Terustrœmiaceæ*, natives of China, Japan, and the north of India, and extensively cultivated as greenhouse-shrubs throughout Europe and the States of America. The species *C. Japonica*, which, as its name indicates, is a native of Japan, has received great attention from the florists of that country and of China from time immemorial. It has shining leaves, flowers without stalks, generally solitary, large, and rose-like. In its wild state the flowers are red; and the red single camellia is much prized by gardeners as a stock on which to graft the fine double varieties which have been developed by cultivation. Some of these varieties are of Chinese or Japanese origin; others have been raised in Britain, continental Europe, and America. Their colours are various, and the varieties differ much in the form and position of the petals. Camellias flower in the autumn, winter, and spring. They are propagated by cuttings and by layers, or, when the finest varieties are dealt with, by grafting and inarching. The single camellia is often propagated by seed, and in this way the finest stocks for grafting are produced. Of the other species cultivated, the most hardy, and one of the most beautiful, is *C. reticulata*. From this and *C. japonica* many splendid hybrids have been produced. The seeds of *C. oleifera*, which is extensively cultivated in China, yield by expression an excellent kind of salad-oil. *C. sasanqua* has fragrant flowers, which are said to be used in some parts of China for flavouring teas.

CAMELLIACEÆ. (*See* TERUSTRŒMIACEÆ.)

CAMELOPARD, *kam-el'-o-pard* (Lat., *camelus*, camel, *pardalis*, panther. (*See* GIRAFFE.)

CAMEL'S THORN. (*See* ALHAGI.)

CAMOMILE, OR CHAMOMILE. (*See* ANTHEMIS.)

CAMPANULA, *kam-pan'-u-la* (Lat., a little bell), the Bell-flower, a genus of plants forming the type of the natural order *Campanulaceæ*. It includes several British species, which are known to all lovers of wild flowers; thus, *C. rotundifolia* is the hare-bell; *C. glomerata*, the clustered bell-flower; and *C. Rapunculus*, the rampion. The roots of the latter species are eaten in some parts.

CAMPANULACEÆ, *kam-pan-u-lai'-se-e*, a natural order of dicotyledonous plants in the sub-class *Corolliflorœ*, consisting of herbs or undershrubs. There are 29 genera and 500 species, chiefly natives of the temperate parts of the northern hemisphere.

CAMPANULARIA, CAMPANULARIDÆ, *kam-pan-u-lai'-ri-a*, a genus and family of zoophytes. (*See* ZOOPHYTES.)

CAMPHOR, *kam'-for* (Gr., *kamphogen;* Arab., *kaphoor*), a solid crystalline substance found in many plants, though only obtained in large quantities from two: namely, *Camphora officinarum* and *Dryobalanops aromatica*. The former, an evergreen tree growing in China, Formosa, and Japan, yields almost all the camphor of European commerce. The camphor, which may be regarded as a solid volatile oil, is diffused through the entire plant, and is separated from the root, trunk, and branches. These parts are cut into chips, and boiled in water till the camphor begins to adhere to the stirring-rod, when the liquid is strained and allowed to stand until the camphor concretes. It is then sublimed into inverted straw cones contained within the earthen capitals of the stills. Vast quantities of this *crude camphor* are procured from the province of Fokien, in China, and the opposite island of Formosa; but some of good quality is exported from Japan. It is generally in small greyish, slightly sparkling grains, which, by aggregation, form crumbling cakes. Refined camphor is prepared by mixing the crude product with lime, and subliming it into thin glass vessels of a peculiar shape, which are afterwards cracked so as to obtain the camphor in concavo-convex cakes, each about three inches thick, with a hole in the middle. Camphor is colourless and translucent, and has a strong, penetrating, aromatic odour, and a bitter, rather pungent, taste, though leaving a sensation of coolness in the mouth. Its specific gravity is from ·98 to ·99; so that it floats upon water, and, evaporating while doing so, undergoes a curious rotatory movement. It volatilizes slowly at ordinary temperatures, melts at 288° Fah., boils at 400°, and burns with a bright flame. It is soluble in alcohol, ether, oils, and dilute acids; also to a certain extent in water. The Sumatra, or Borneo, camphor is the produce of *Dryobalanops aromatica*. It greatly resembles the ordinary camphor, but is never seen in European commerce, because the Chinese give a price for it eighty or a hundred times greater than that at which they sell their own camphor. The same tree which affords this rare substance yields also a pale yellowish limpid fluid, called *liquid camphor*, or *camphor oil*. Camphor is used in medicine, both internally and externally, as a temporary stimulant, and in some cases as a remedy for gout and rheumatism. In moderate doses, it will allay nervous irritation and produce quietude and placidity of feeling. The alcoholic solution of camphor and liniments, of which it is the principal ingredient, are much used for external application in sprains and bruises, chilblains, and chronic rheumatism. Insects are kept from attacking specimens of natural history by placing pieces of camphor in the cases in which such specimens are preserved. Chemically considered, camphor is a compound of carbon, hydrogen, and oxygen, in the proportions expressed by the formula $C_{10}H_8O$.

CAMPHORA, *kam-fo'-ra*, in Botany, a genus of plants belonging to the natural order *Lauraceæ*. The most interesting species is *C. officinarum*, the camphor-tree, a native of China, Formosa, and Japan, where it grows to a considerable size. It is an evergreen, and all parts emit a camphoraceous odour when bruised. The wood is white, light, and durable, and is much used in China for carpenter's work. From the roots, trunk, and branches of this plant, the *common*, or *officinal, camphor* is obtained. (*See* CAMPHOR.)

CAMPION. (*See* LYCHNIS and SILENE.)

CAMPYLOSPERMÆ, *kam-pi-los-per'-me* (Gr., *kampulos*, a curve; *sperma*, seed), a sub-order of the *Umbelliferæ*, characterized by the albumen of the seed being rolled inwards at the edges, so as to present a vertical furrow on its face.

CAMWOOD. (*See* BAPHIA.)

CANADA BALSAM. (*See* BALSAM.)

CANAL, OR CANALIS, *ka'-nal* (Lat., *canna*, a reed), is applied to many small passages or channels of the human body.

CANARIUM, *ka-nai'-ri-um*, a genus of trees belonging to the natural order *Amyridaceæ*, natives of the Spice Islands and parts of Asia. *C. commune* is cultivated for the sake of the kernels of its fruit, and for the fragrant resinous substance which exudes from its bark, which probably constitutes the manilla elemi of commerce. This tree is about 50 feet high. *C. microcarpum* yields an oil very like copaiva, known in ship-building yards as Damar. Other species produce edible fruits, useful oils, and resins.

CANARY, OR CANARY-BIRD, *ka-nai'-re* (*Carduelis canaria*). This popular and pretty singing-bird is a native of the Canary Islands; it is also found in Madeira and the Cape Verd Islands. It belongs to the numerous family of finches (*Fringillidæ*) being the *Fringilla Canaria* of Linnæus; by some ornithologists, however, it is placed in the genus *Carduelis*, and by others in the *Linota*, while there are others who make of it a genus by itself, *Canaria*. Its introduction into Europe was somewhat singular. According to some authorities, at the end of the 14th century, and to others, at the beginning of the 16th century, a vessel containing, among other merchandise, a number of canary-birds, and which was bound for Leghorn, was wrecked on the coast of Italy. The birds, being set at liberty, took refuge in the adjacent island of Elba, and the climate being congenial to their habits, they increased considerably. The islanders, finding such an elegant songster suddenly settling in their country, were anxious to become possessors of them, and quickly the whole colony of canaries were taken prisoners. From Italy they were brought to other countries, and became highly valued as singing-birds. The wild bird of the Canary Islands and the domesticated bird so familiar in this country are quite at variance in personal appearance. The colour of the wild canary is a dusky grey; whereas, in the domesticated canary, we have a great variety of colours —green, yellow, white, brown, grey, &c. This is, of course, owing to the numerous cross-breedings to which it has been subjected. It breeds freely with several other species; the goldfinch, the bullfinch, the siskin, the green-bird, and the linnet, among the number. Altogether, it is reckoned that there are no less than thirty varieties of the canary. The canary that is most admired amongst us now is one with the body whitish yellow; the head (particularly if crested), wings, and tail, yellowish-dun. The second in degree is of a golden yellow, with the head, wings, and tail black, or, at least, dusky grey. In Germany and the Tyrol the breeding of this bird is carried on on an extensive scale, and it is principally from these places that the rest of Europe is supplied. In its native home, the canary builds its nest in thick, bushy, high shrubs and trees, with roots, moss, feathers, hair, &c.; pairs in February, lays from four to six pale-blue eggs, and hatches five and often six times in the season.

CANARY-GRASS. (*See* PHALARIS.)

CANCELLARIA, *kan-sel-la'-ri-a*, a genus of mollusks with univalve shells, now usually placed among the *Buccinidæ* or Whelks. The recent species are natives of tropical seas, and are found chiefly on sandy bottoms. The fossil species appear in the newer strata. (*See* WHELK.)

CANCELLI, *kan-sel'-li* (Lat., lattice-work), the spongy or reticular substance of the bones (*See* BONE.)

CANCER, *kan'-ser* (Lat., *cancer*, a crab), a group of stars forming the fourth of the twelve constellations of the Zodiac, although it is many centuries since the constellation and the sign occupied the same position. The zodiacal division so called occupies the thirty degrees of the ecliptic between 90° and 120° from the first point of lines, or the vernal equinox. The sun enters this sign about the 21st June, and leaves it about the 22nd July. It contains 83 stars, of which the most conspicuous is *Acubens*, a star of the third magnitude.

CANCER (so called from the large blue veins which appear, in cancer, to resemble crab's claws), a disease of a very malignant character, and one of the class of new growths. It differs from all other tumours, being an infiltration amongst the natural tissues of the body. Its peculiar construction can only be discerned by the microscope.

Any part of the body may be the seat of this disease, though the glands are most liable to its attack. The female breast, the tongue, or lips, are among the parts most subject to it. There are several forms of cancer, *scirrhous*, *medullary*, *melanic*, *epithelial*, *osteoid*, *colloid*, and *villous*. The most frequent form is the scirrhous. Its first appearance is that of a small stony-hard tumour, which is due to the abundance of fibrous tissue. There is at first little or no discolouration of the surrounding skin. It remains in this state for a longer or shorter period, sometimes for years, but at length it passes into a more active condition:—the tumour increases in size, the skin changes to a livid or red appearance, and pain begins to be felt in it. The pain, which is of a shooting or lancinating nature, is at first slight, and occurs at considerable intervals; but it increases by degrees, and the intervals diminish until it becomes almost constant. The cutaneous veins become turgid, and the surface of the tumour presents to the feel a knotty, uneven surface. Sometimes the skin never actually breaks, but usually, after a longer or shorter period, the tumour ulcerates and becomes an open sore. The disease pursues its onward course; sometimes it seems as if it had exhausted itself, and was allowing nature to work a cure by the formation of new flesh; but this is merely a delusion, for it soon recommences its destructive course, and at length, it may be after years, it seizes upon some vital organ, or the patient sinks exhausted by the pain and continued drain upon his system. Of the cause, nature, or treatment of this terrible disease little is, unfortunately, known. By some it is regarded as constitutional, by others as local; some maintain that it is hereditary, others that it may be transmitted by inoculation. Though all ages and both sexes are liable to this disease, the young are less frequently attacked by it than the old, and females are more subject to it than males. The only hope of a cure in cancer is by extirpating the tumour in its earliest stages; and even this, after all, frequently affords but a temporary relief. Sometimes, in place of the knife, escharotics, as chloride of zinc, are had recourse to, but with no better success. Among the lower animals this disease is not of unfrequent occurrence, the animals most liable to its attack being the dog and cat.

CANCER, a genus of short-tailed *Crustacea*, or crabs, now generally restricted to the common crab. (*See* CRAB.)

CANCER-ROOT. (*See* EPIPHEGUS.)

CANCRUM ORIS, *kan'-crum o'-ris*, canker of the mouth, an ulcerative affection of the gums and cheeks seldom observed in adults, and occurring principally among young children. It is occasioned by poor feeding, and residence in a state of dirt and squalor. A more severe form attacks children when just recovered from measles, when many patients are crowded together. Deep foul ulcers appear, the gums become gangrenous, and there is a fœtid discharge from the mouth. Strong beef-tea and plenty of nourishing food and flesh are required, while the local treatment demands energy and skill. The mouth should be frequently washed with weak solution of carbolic acid.

CANDLE-TREE. (*See* CRESCENTIACIACEÆ.)

CANDLEBERRY, known also as Candleberry Myrtle, Bayberry, Tallow Tree, Wax Tree, or Wax Myrtle. (*Myrica cerifera*), a low spreading shrub or tree found in America, bearing berries, about the size of pepper corns, which, when ripe, are covered with a whitish green wax. The berries are boiled, and the wax, which rises to the top, is then skimmed off, and afterwards melted and refined and made into candles. They burn with a feeble light but give an agreeable balsamic odour. A bush of berries yields from four to five pounds of wax. A pleasantly scented soap is also made from the wax.

CANDLE FISH, OR EULACHON, a remarkable fish (*Thaleichthys Pacefecus*) of the family *Salmonidæ*. It is a sea fish, but approaches the coasts to spawn. It is found in the Pacific Ocean, near the north western shores of America, is of a greenish-olive colour on the back, with white sides and belly, and a few yellow spots, and is about seven inches long. It is a remarkable oily fish, and the Indians pass a strip of rush or bark through it for a wick and use it as a candle, whence the popular name. The flesh is dried for food and oil is obtained from the fish by the Indians.

CANDLE NUT, a heart-shaped nut, about the size of the walnut, the fruit of the tree *Aleurites triloba*, sometimes known as the candle nut tree. It is a member of the order *Euphorbiaceæ*, and is found in the South Sea Islands, Madagascar, Malacca, Java, &c., a gummy substance exudes from it, which some of the natives chew. The nut has a hard shell which yields a lamp black used in tattooing, and the kernel is fit for food when roasted. In the raw state it usually causes purging and colic. A bland oil is expressed from it which is used for food and also for lamp-oil. After being slightly boiled, holes are bored in the kernels and they are strung on a rush to be burned as a torch. This is done by wrapping four or five strings together in a leaf of the screw-pine (*Pandaum*), when they burn with so much brilliancy that they are used for fishing by night.

CANDYTUFT (*Iberis*), a genus of plants of the natural order *Cruciferæ*. The genus is divided into several species, one of which is a doubtful native of Britain (*I. amara*), and is very bitter; another comes from Candia (hence the name), and another from Spain-Iberia, hence the Latin designation. Some are annuals, some herbaceous perennials. The most familiar are the annual White and Purple (*I. umbellata*), the Sweet-scented (*I odorata*), and two slightly shrubby species (*I semper virens* and *I semper florens*). The latter, as its name implies, will blossom throughout the year in favourable situations.

CANE, *kain* (Lat., *canna*), a term commonly applied to any small smooth stick of the thickness of an ordinary walking stick or even less, but more correctly limited to the stem of small palms or large grasses. Thus we speak of sugar cane, bamboo cane, &c. The name is particularly applied to the species of the genus *Calamus*, known as rattan, and it is also to this genus belong the cane largely imported from the eastern tropics for making the bottoms of chairs, couches, &c. (*See* CALAMUS, BAMBUSA.)

CANE-BRAKE (*Arundinaria macrosperma*), a large reed or grass allied to the bamboo, found in marshy situations of the warmer parts of North America.

CANE SUGAR. (*See* SUGAR.)

CANELLA, *ka-nel'-la*, often called Wild Cinnamon, the typical genus of the natural order *Canellaceæ*. The inner bark of *C. alba* forms the Canella of the apothecaries. The tree is common in many parts of South America and in the West India islands; in commerce, white wood bark and white cinnamon. The bark is removed and dried in the shade. It is seen in flat or quilled pieces, of a light buff-colour, and from having been confounded with Winter's bark (*see* DRIMYS), it is sometimes called spurious Winter's bark. Being aromatic, stimulant, and tonic, it is used in medicine, and sometimes as a spice. Distilled with water, it yields an essential oil, which is often mixed with, and sometimes sold for, oil of cloves.

CANELLACEÆ, *ka-nel-lai'-se-e*, the Canella family, a natural order of dicotyledonous plants, in the sub-class *Thalamifloræ*. There are but two genera known—*Canella* and *Cinnamodendron*, which consist of evergreen shrubs possessing aromatic properties.

CANES VENATICI, *ka'-nez ven-a-ti'-ci* (Lat., hunting dogs), a constellation of the northern hemisphere. Within the limits of this constellation are several very remarkable nebulæ.

CANINA, CANIDÆ, *kan-i'-na* (Lat., *canis*, a dog), the dog tribe, which includes dogs, foxes, wolves, and jackals, all of which have a similar dentition. (*See* VARIOUS HEADINGS.)

CANIS MAJOR, *kai'-nis mai'-jor* (Lat., *canis*, dog; *major*, greater), a constellation of the southern hemisphere containing Sirius (*see* SIRIUS), which is the brightest star that appears in the heavens. It is situated below Orion, and a line drawn through the stars composing Orion's belt will pass through Sirius if prolonged. Besides this brilliant star, the constellation contains one of the second magnitude and many of the third and forth; 31 in all.

Canis Minor, a constellation of the southern hemisphere between Gemini and Canis Major. It contains one of the first magnitude called Procyon, which lies in a direct line between Sirius and Pollox. It contains 14 stars.

CANKER, *kank'-er* (Lat., *cancer*), a kind of gangrene which attacks young shoots and branches, and then the trunks of trees. If not cured or its progress prevented by cutting back the tree, that it may throw out new branches, it will gradually destroy it in the course of a few years. It is produced by accidental injury to the branches, or by superabundant moisture about the roots, that a stiff subsoil will not allow to drain away. Canker is also a name vaguely given to various diseases, attacking human beings and some of the lower animals, especially dogs and horses, characterised by the ulceration of the parts affected and the growth of a fungoid excrescence.

CANNA, *kan'-na*, a genus of plants belonging to the natural order *Marantaceæ*, or Arrow-root family.

CANNABINACEÆ, *kan-na-bi-nai'-se-e*, the Hemp family, a natural order of plants of the class *Dicotyledones*, sub-class *Monochlamydeæ*; consisting of rough herbs with a watery juice. There are only two genera—*Cannabis* and *Humulus*, the Hemp and the Hop, and each consists of but one species. (*See* HEMP and HOP.) They are natives of the temperate parts of Europe and Asia.

CANNABIS, *kan'-a-bis* (Lat.), the Hemp, a genus of plants representing the natural order, *Cannabinaceæ*.—*Cannabis sativa*, the only species, yields the valuable fibre called hemp, known from time immemorial as a material for cordage, sacking, and cloth. (*See* HEMP.)

CANNEL COAL, *kan'-nel kole*, a brittle, compact variety of coal having a waxy lustre and a conchoidal fracture. It burns with a bright flame, emitting large quantities of gas, which renders it particularly valuable for gas-making. Cannel coal is a corruption of candle coal, a name given to it from the candle-like brilliancy of its flame. The Scotch miners call it *parrot coal*, from the chattering noise it makes when thrown into the fire. Some of the harder varieties are used for working into ornaments like jet.

CANNON-BALL TREE, *Couronpita Guianensis*, a large tree, native of Guiana of the natural order *Lecythidaceæ*. It bears fruit resembling large cannon balls, the hard woody shells of which are often used for drinking vessels.

CANOPUS, *ka-no'-pus*, a very bright star of the first magnitude in Argo, a constellation of the southern hemisphere. The origin of the name is uncertain; but it was probably derived from the ancient Egyptian city Canopus, or Canobus, which was situated on one of the mouths of the Nile called the Canopic mouth, about three miles distant from the modern Aboukir.

CANTERBURY BELLS. (*See* CAMPANULA.)

CANTHARADIN, *kan-tha'-ra-din*, the crystalline blistering principle contained in the *Cantharis vesicatoria*, or Spanish blister-fly. To procure it the flies are digested in alcohol. The alcoholic solution is afterwards evaporated to dryness, and washed with cold ether, which dissolves out the cantharadin. When pure, it is insoluble in water, but very soluble in boiling alcohol. Lard containing one five-hundredth of cantharadin will produce a very powerful blistering effect when applied to the human skin.

CANTHARIDÆ, *kan-thar'-e-de* (Gr., *kantharos*, a beetle), the name given to a family of coleopterous insects, very numerous, much variegated in colours, of moderate size, and generally living on vegetable substances. They are distinguished by the head being dilated behind the eyes, and then suddenly narrowed into a short neck. When alarmed, they counterfeit death; and some varieties at the same time emit a thick yellowish fluid, with a disagreeable smell, from the articulatories of the legs, &c. Many species are employed externally in medicine to produce blisters, as they possess strong vesicating powers. Many species of the genus *Cantharis* which possess this property are natives of Europe, India, and America. The *Cantharis vesicatoria* is the common blister-fly. (*See* BLISTER-FLY.) The stripped cantharis is a native of North America, where it is called the Potato-fly. The genus *Mylabris* contains several species, which have properties similar to those possessed by the Cantharis; and the genus *Meloe* has also various species which have all the properties of the blister-fly.

CAOUTCHOUC MINERAL, *ka-oot'-chook*, an elastic bituminous mineral, resembling caoutchouc in its physical properties. A few specimens of this substance have been found in a lead mine in Derbyshire, in a coal mine at Moxbrelais, and in bituminous limestone at Woodbury, in Connecticut.

CAPACITY, SPECIFIC INDUCTIVE, *ka-pas'-i-te*, a term applied by Faraday to indicate a difference in the powers or capacities which various dielectrics (materials between the plates of an electric battery) possess for transmitting statical inductive influence across them. Numbers expressing the difference with reference to some common standard are named the *specific inductive capacities* of the substances. Thus, air being taken as unity, the following numbers represent the capacities of various substances: spermaceti, 1·45; resin, 1·7; pitch, 1·80; wax, 1·86; glass, 1·90; shellac, 2; sulphur, 2·24. The specific inductive capacity of all gases is the same.

CAPELLA, *ka-pel'-la* (Lat., *capella*, a she-goat), a brilliant star of the first magnitude in the constellation Auriga.

CAPERCAILZIE, OR CAPERCAILIE, *ka-per-kail'-ze* (*Tetrao urogallus*), a bird of the Grouse species, whose appellation is of Gallic origin, and means "horse of the wood;" it is also called the Cock of the wood. It is the largest of the gallinaceous birds of Europe, and was formerly common in the Highlands of Scotland, but became extinct. It has, however, recently been re-introduced. It prefers the pine forests of Norway and Scandinavia, in which regions it is found in abundance. The food of the capercailie consists of the leaves of the Scotch fir, also various berries found in the North. The young have a more luxurious diet, feeding on ants, worms, and other insects. The size of this species varies considerably; in some cases a full-grown male (which is one-third larger than its mate) will scarcely weigh ten pounds; whereas it will sometimes exceed sixteen pounds. The capercailie may lay claim to considerable beauty. Its plumage is beautifully glossy, mottled with grey and brownish-black, the neck and breast black, tinged with a rich green. The female's attire, unlike its more resplendent mate, is humble, and is variegated with yellowish-brown, white, and brownish-black. It is much esteemed for the table.

CAPERS. (*See* CAPPARIS.)

CAPILLARIES, *kap-il'-la-rees* (Lat., *capillus* a hair), the minute blood-vessels of the body, which form the connection between the extremities of the arteries and the veins. It is in the capillaries that nearly all the changes in the blood take place.

CAPILLARY ATTRACTION, OR ACTION, a term applied to the phenomena produced when solid bodies are brought into contact with liquids. These phenomena are best observed in small tubes, about the diameter of a hair—hence the name. In all cases, although the phenomena are very varied in their nature, the result may be attributed to the mutual attraction of the liquid molecules for each other, and to the attraction between these molecules and solid substances. When a solid substance is immersed in a liquid which wets it, as, for instance, a glass rod in water, the liquid becomes curved upwards towards the side of the solid, making its surface slightly concave, instead of being horizontal. If, however, the liquid does not wet the solid, as, for instance, a glass rod dipped into mercury, the liquid is depressed against the sides of the solid and assumes a convex shape. The surface of the liquid against the sides of the vessel which contains it is also concave or convex, according to whether the liquid does or does not wet it. If a small tube, instead of a glass rod is employed, these phenomena become much more apparent. The liquid ascends, or is depressed, according to whether the tubes are moistened by the liquids or not. The amount of ascent or depression is proportionately greater according to the diameter of the tube. Analogous capillary phenomena occur when two bodies of any given shape are immersed in water, provided they are sufficiently near. If two parallel plates of glass are immersed in water at a short distance from one another, the water will rise between them in the inverse ratio of the separating distance. If the plates are immersed in mercury instead of water, a corresponding depression is the result. If two glass plates, inclined to one another at a small angle, be so immersed in a liquid which wets them that the line of contact between the two plates is vertical, the liquid will rise towards the summit of the angle of the two plates. The theory of capillary attraction is one of the most difficult in physics, and can only be completely treated by mathematical analysis. The effects of capillary attraction are to be observed in many operations in nature. By it the blood circulates in the porous tissues of animals, water is supplied to the roots of growing plants, and moisture is raised to the surface for the maintenance of vegetable life in seasons of drought. Insects can often move on the surface of water, because their feet are not wetted by the fluid, and a depression is caused which buoys them up. A polished sewing-needle will float on the surface of water. Oil ascends in the wicks of lamps by capillary attraction, and water rises in wood, sponge, bibulous paper, and other substances, by the same force.

CAPITULUM, *ka-pit'-u-lum*, a kind of inflorescence, consisting of a close terminal collection of flowers surrounded by an involucre. It constitutes the *compound flower* of Linnæus, and is also known under the names *anthodium* and *head*.

CAPNOMOR, OR KAPNOMOR, *kap'-no-mor* (Gr., *kapnos*, smoke, and *moira*, a part), a colourless oil of peculiar odour, resembling that of ginger, discovered by Reichenbach, amongst other products, in heavy oil of tar. It is limpid and volatile, insoluble in water and solution of potash, but dissolving readily in alcohol, ether, and the essential and fixed oils. Its specific gravity is slightly below that of water. It boils at 345° Fah. and distils unaltered. It is obtained by distilling a solution of crude creosote in potash and with water. With sulphuric acid it forms a purple-red solution.

CAPPARIS, *kap'-par-is*, the Caper-bush, the typical genus of the sub-order *Cappareæ*, of the natural order *Capparidaceæ*. The pickled flower-buds of various species are used under the name of capers. Those eaten in Europe are the produce of *C. Spinosa*, a trailing shrub which grows in rocky places in the south of Europe. It is the only species of the order found on the north of the Mediterranean. The seeds of the caper of Mount Sinai (*C. Sinaica*) are pickled and used instead of pepper. The capers used in Barbary are obtained from *C. Fontanesii*, and those used in Egypt from *C. Ægyptiaca.* It has been suggested that the latter species is the hyssop of Scripture. (*See* HYSSOP.)

CAPPARIDACEÆ, *kap-par-i-dai'-se-e* (from the Arab., *kapar*, capers), the Caper family, a natural order of dicotyledonous plants in the sub-class *Thalamifloræ*, including 28 genera and about 340 species—herbs, shrubs, and a few trees, mostly natives of tropical and sub-tropical regions. The two kinds of fruit, one dry and pod-like, the other a berry, have led to a division of the order into two sub-orders—viz., *Cleomeæ*, characterised by a capsular fruit, and *Cappareæ*, by a baccate fruit or berry. In their properties the *Capparidaceæ* greatly resemble the *Cruciferæ*, being generally pungent, stimulant, and antiscorbutic. Some are aperient, diuretic, and anthelmintic.

CAPRA, the Goat. (*See* GOAT.)

CAPRICORNUS, *kap-re-kor'-nus* (Lat., *capricornus*, a goat), a constellation in the southern hemisphere, from which the tenth sign of the zodiac, between 270° and 300° of longitude from the first point of Aries, originally derived its name. The sun enters the winter solstice in this sign which is usually represented as having the forepart of a goat and the hind part of a fish.

CAPRIDÆ, *kap'-ri-de*, a family of ruminant quadrupeds, constituting the sheep and goat family, in which some naturalists include antelopes.

CAPRIFOLIACEÆ, *kap-ri-fo-li-ai'-se-e* (Lat., *caper*, goat; *folium*, leaf, in reference to the climbing habit of the plant), the Honeysuckle family a natural order of dicotyledonous plants in the sub-class *corollifloræ*. There are 16 genera and about 220 species, chiefly natives of the northern parts of Europe, Asia, and America. They often have showy flowers, which are commonly sweet-scented. Many are cultivated in our gardens and shrubberies; as Honeysuckles, which are species of the genera *Caprifolium* and *Lonicera*; Guelder-roses, species of *Viburnum*; the Laurustinus (*Viburnum Tinus*); the Snowberry (*Symphoricarpus racemosus*); and the common Elder (*Sambucus nigra*). Some of the plants are emetics and mild purgatives; others are astringent; others sudorific and diuretic; and a few are acrid.

CAPRIMULGIDÆ, *kap-ri-mul'-ji-de*, a family of birds of the order *Insessores* and tribe *Fissirostres*, nearly allied to the swallow tribe. They are insectivorous, have long wings, short legs, and toes united at the base by a membrane. The family includes the goat-sucker, the whip-poor-will, and the American night-hawk.

CAPSICINE, *kap'-si-sene* (from *capsicum*, derived from Gr., *kapto*, I bite, in allusion to its pungency), an alkaloid found in the capsules of the various species of capsicum used in the manufacture of cayenne pepper. It has a burning taste; is insoluble in water and ether, but soluble in alcohol, and may, when quite pure, be crystallized. It forms salts with nitric, sulphuric, and acetic acids.

CAPSICUM (from Gr., *kapto*, I bite), a genus of plants belonging to the natural order, *Solanaceæ*, consisting of numerous species. Though now extensively cultivated in many parts of the Old World, the various species are supposed to be natives of South America. The officinal capsicum, the *C. annuum* of Linnæus, or the *C. fastigiatum* of Blume, has oblong cylindrical fruits, not an inch long in the most valuable varieties, but two or three inches long in others. These fruits are commonly sold as *Chillies*, and are used to make a hot pickle, and the liquid known as *Chili vinegar.* Cayenne pepper consists of the powdered fruits of several species of capsicum, found in the West Indies and South America. In medicine, the fruit of the capsicum is used as a counter-irritant: with salt as a stimulant in scarlatina; as a gargle in relaxed sore-throat; and in the form of Cayenne lozenges.

CAPSULE, *kap'-sule* (Latin, *capsa*, a chest), a one or more-celled, many-seeded, dry, dehiscent fruit. It is *syncarpous*, that is, formed of several carpels united together. The dehiscence or opening of the capsule may either take place by valves, as in the foxglove, primrose, and rhododendron, or by pores near the summit, as in the poppy and snapdragon. The distinctive name of *Pyxis* or *Pyxidium* has been given to a beautiful kind of capsule, which opens as if cut around near the summit, and presents the appearance of a cup with a lid. Examples of the latter may be seen in the pimpernel and henbane. The capsule is one-celled in the mignonette, heart's-ease, and gentian; two or more celled in the scrophularia, colchicum, iris, and datura. It is a very common form of fruit.

In Anatomy, a membranous production, inclosing any part like a bag; as the capsular ligaments inclosing the synovia of the joints, the capsule of the crystalline lens of the eye.

CAPUCHIN MONKEY, a name given to some South American monkeys, of the genus *Cebus*, which has the head covered with short hair, so disposed as to resemble the cowl of a Capuchin monk. The name Capuchin Sapajou is sometimes used.

CAPUT, *kai'-put* (Lat., the head), that portion of the human body which comprises the skull and face. The skull is distinguished into the following parts:—the *vertex*, or crown; the *sinciput*, or fore part of the skull; the *occiput*, or hind part; the *tempora*, or temples. The parts of the *facies*, or face, are the forehead, eyes, nose, &c. (*See* FACE.) The term *caput* is also applied to—1, the upper extremity of a long bone, as the humerus; 2, the origin of a muscle; 3, a protuberance resembling a head, as the *caput Galli-naginis*, a small eminence in the urethra; 4, the beginning of a part; as *caput coli*, the head of the colon.

Caput Obstifrum (Lat., stiff head), denotes wry-neck, an involuntary and fixed inclination of the head towards one of the shoulders.

CAPYBARA (*Hydrochærus capybara*), *kap-i'-ba-ra.* A rodent animal found in South America, in general appearance greatly resembling a small pig, and sometimes called the Water Hog; or, in Demerara, the Water Horse, a corruption of the Danish Water Haas, water hare. The dentition shows a link of connection between the rodents and the pacherdymata. It feeds on vegetables, and is especially fond of the sugar cane. The flesh of the young animal is eaten.

CARABIDÆ, *ka-rab'-i-de* (Gr., *karabos*, a beetle), a family of coleopterous insects, comprising several species. In general, the members of this family prey upon insects; and the construction of their bodies is eminently adapted for this purpose, being very firmly encased in a stout covering, enabling them to search among the stones, crawling over and under them for their prey without fear of hurt; at the same time they can suffer but little from the attacks of other insects. The Bombardier Beetle (which *see*) belongs to this family, and a very large and singular insect of the tribe is the *Mormolyce phyllodes*, a native of Japan, which has an extremely flattened body. Some species of the Carabidæ are, it has been ascertained, herbivorous, finding their food principally in the cornfields.

CARACAL, *ka-ra-kal'* (*Felis Caracal*), sometimes called the Persian lynx, is found in both the continents of Asia and Africa. This animal is the lynx of the ancients. It is about three feet in length, of a pale reddish-brown above, and whitish beneath. It has a small head, although somewhat elongated, and ears with tufts of long black hair. In disposition it is fierce and savage, and it possesses great strength. It can, however, be tamed, and is used as an animal of chase.

CARACARA, *ka-rak'-a-ra* (*Polyborus*), a genus of birds of prey, regarded as a connecting link between eagles and vultures. They are peculiar to the American continent, and the name is derived from the harsh cry of a common Brazilian species (*P. Braziliensis*). This bird has very fine plumage, and measures from tip to tip of the wings, when expanded, about 50 inches. The hooked bill and claws resemble those of the eagle; but the naked face and the liking for carrion give a resemblance to the vulture.

CARADOC SANDSTONE, *kar'-a-dok.* (*See* BALA LIMESTONE.)

CARAMBOLE. (*See* AVERRHOA.)

CARAPA, *ka-rai'-pa* (from *caraipe*, its African name), a genus of tropical plants belonging to the natural order *Meliaceæ*. *C. Guineensis*, an African species, yields a fatty oil called kundah or tallicoonali, which is purgative and anthelmintic. Besides being valuable in medicine, it is well adapted for burning in lamps. It is expressed from the seeds. The bark of the tree has febrifugal properties. *C. Guineensis*, a native of Guiana, South America, and the adjacent countries, furnishes similar products; indeed, it is somewhat doubtful whether the species are essentially distinct.

CARAPACE, *kar'-a-pace*, the strong shell or shield covering the backs of tortoises, turtles, crabs, lobsters, &c.

CARAWAY. (*See* CARUM.)

CARBAMIC ACID, *kar-bam'-ik.* When dry carbonic acid and dry ammoniacal gas are mixed, a white substance results, which was formerly supposed to be anhydrous carbonate of ammonia. Later investigations proved that it was a compound, containing ammonia combined with carbonic acid. Carbamic acid forms salts with numerous other bases, which are interesting only in a theoretical point of view.

CARBAMIDE, *kar'-bam-ide*, a peculiar compound, formed by the action of ammonia on chloro-carbonic acid. It is said to be identical with urea. (*See* UREA.) Carbamide may be regarded as carbonic acid with an equivalent of oxygen, replaced by an equivalent of amidogen.

CARBAZOTIC ACID, OR PICRIC ACID, *kar'-bai-zot'-ik*, a complex acid, produced by the action of nitric acid on a number of organic substances, such as phenic acid, salicin, phloridzin, silk, indigo, and a number of the resins. Carbazotic acid is soluble in 80 or 90 parts of cold water, forming a liquid of a bright yellow colour. It has an intensely bitter taste, and has been used as a fraudulent substitute for hops in making bitter ale. It has been employed in dyeing silk and wool, to which, in conjunction with cream of tartar or alum as a mordant, it gives a fine yellow colour. Carbazotic acid is sometimes employed as a test for potash, with which it forms a bright yellow crystalline precipitate, even in dilute solutions.

CARBON, *kar'-bon* (Lat., *carbo*, a coal)—symbol C, equivalent 6, specific gravity as diamond 3·55, as graphite 1·9 to 2·3—an elementary non-metallic solid body, very widely diffused through nature. Its purest and rarest form is that of the diamond (*see* DIAMOND), but in the forms of graphite and mineral charcoal it occurs very abundantly in nearly every part of the world. It also occurs, in combination with oxygen, as carbonic acid, in small quantities in the air, and in the waters of most springs. In combination, as carbonic acid, with lime and magnesia, it occurs, in enormous quantities, as lime-stone, marble, chalk, dolomite, &c.; whilst, combined with hydrogen, it enters largely into coal, peat, and lignite. From its invariable presence in all organic matter, it has been called the organic element. From entering thus directly into the vegetable and animal creation, carbon may be considered as the most important element; and the pouring out of carbonic acid by animals, to serve for the food of vegetables, is one of the many silent chemical operations constantly going on around us. The wonderful provision of Nature by which the carbonic acid cast out by animals as a poisonous product is converted into food for the support of plants, by the action of the sun's rays, has been the admiration of all philosophers and chemists from the days of Lavoisier to the present time. Carbon, as it exists in the form of the diamond is fully described under that head.

CARBONIC ACID, *kar-bon'-ik*, is the product of the combustion of all substances containing carbon. It exists in the atmosphere to the extent of one volume to 2,500 of air, occurs in combination with metallic oxides in the mineral kingdom, also dissolved in mineral springs. It issues from the earth in volcanic districts, and forms the deadly choke-damp of the coal-mines. It is also a product of respiration, fermentation, and putrefaction, which is nothing more than slow combustion. It is easily prepared by acting on a carbonate, such as chalk or marble, with nitric, sulphuric, or hydrochloric acid, in a gas-generating apparatus. The carbonate of lime is converted into chloride of calcium, and the carbonic acid escapes as gas. Carbonic acid is known in the solid, liquid, and gaseous states. By a pressure of thirty atmospheres, at 32° Fah., it is liquefied, the pressure requires decreasing as the temperature gets lower. Liquid carbonic acid is colourless, insoluble in water and fatty oils, but mixing in all proportions with ether, alcohol, bisulphide of carbon, naptha, and turpentine. At—94° Fah. it solidifies into a vitreous transparent mass. Solid carbonic acid is best prepared by generating carbonic acid in a condenser until it is liquid, and then allowing it to escape through a stop-cock into the air. The liquid gas evaporates with such rapidity that intense cold is produced, and the remainder is converted into snow. It is a bad conductor of heat, and may be handled with impunity, a film of gaseous carbonic acid always protecting the hand from injury. If pressed upon the skin, a blister is produced similar to that caused by a burn. It is used, in conjunction with ether and bisulphide of carbon, for producing intense cold. Gaseous carbonic acid is colourless, possessing a slightly acid smell and taste. At ordinary temperatures it dissolves in water in the proportion of bulk for bulk. By pressure water may be made to take up great quantities of the gas, the same *volume* being always absorbed, no matter how great the pressure may be. Upon the removal of the pressure, the gas escapes in bubbles. A familiar instance of this occurs in the effervescence of bottled beer or aërated waters. When inhaled, carbonic acid produces death, even when much diluted. A lighted candle is generally used to test an atmosphere suspected to contain carbonic acid; but it is found that air that will support combustion will contain sufficient of this gas to cause insensibility and dangerous illness. It is the deadly poison of the Upas valley of Java, of the Grotto del Cane, near Naples, and of the Laach lake in Rhenish Prussia. Carbonic acid produced during respiration may be shown by breathing through a tube into lime-water, which is at once rendered cloudy by the formation of carbonate of lime. The ill effects of crowded rooms are owing to the systemic depression produced by small quantities of carbonic acid. Carbonic acid was formerly called *fixed air*, from the fact of its having been discovered as a solid or fixed constituent in limestone by Dr. Black, in 1757. Though a feeble acid, and easily separable from its combinations, carbonic acid unites with the metallic oxides, forming a very numerous and important class of salts, the carbonates, descriptions of which will be found under the headings of their bases. The carbonates of the alkalies are soluble in water, the carbonates of the other metallic bases being for the most part insoluble, except the water is highly charged with carbonic acid. Hard water contains carbonate of lime or magnesia, held in solution by the carbonate acid contained in the water: hence, when the gas is dissipated by boiling, the carbonate of lime is precipitated, incrusting the vessel in which it has been boiled. Carbonic acid contains one equivalent of carbon, united with two of oxygen. Its true composition was discovered by Lavoisier, who bestowed on it the name it bears.

CARBONIFEROUS SYSTEM, *kar-bon-if'-e-rus*, in Geology, the name given to the great assemblage of fossiliferous strata resting upon the old Red sandstone, and capped by the Permian series. To this system the great coal-fields of the world belong. It consists of alternations of sandstones, shales, clays, limestones, coals, and ironstones, in every degree of admixture and purity, and of every condition of formation—terrestrial, fresh-water, estuary, and marine. In the strata there have been discovered fossils representing all the great forms of life, with the exception, perhaps, of true dicotyledonous plants in the vegetable kingdom, and of birds and mammals in the animal kingdom. The most striking peculiarity in the system is the profusion of fossil vegetation which marks almost every stratum, and which, in numerous instances, forms thick seams of solid coal. Although this *coaly* or *carbonaceous* aspect prevails throughout the whole, it has been found convenient to arrange the system into three groups—The lower coal-measures or carboniferous slates, the mountain or carboniferous limestone, and the upper or true coal-measures; or more minutely, according to the views of most British geologists, into the following series:—1, upper coal-measures; 2, millstone grit; 3, mountain limestone; and 4, lower coal-measures. Other sub-divisions have been attempted, according to the local peculiarities of different coal-fields; but it is enough for the purposes of the general reader to know, that all these minor arrangements can be readily co-ordinated with one or other of the above four series.

CARBUNCLE, *kar bun'-kl* (Lat., *carbunculus*, a little coal), is a broad, flat, firm, burning tumour, usually of considerable size. It begins with a hard, painful swelling, of a livid colour, which rapidly enlarges. The pain is severe, and is much increased by pressure; the patient is much depressed, and a general derangement of the system takes place. Vesicles form on the part, which soon open, and discharge a thin viscid fluid, with occasionally slaughed portions of disintegrated tissue. Sometimes these apertures run into each other, and form large openings. The predisposing cause of this disease is a derangement of some of the secretions of the human body, which is to be remedied by purgative and other medicines suited for each particular case; the system being at the same time supported by tonics and a nourishing diet. This, however, is not enough—an early and free application of the knife is necessary to the part itself. An incision, usually in the crucial form, throughout the whole extent of the diseased massevacuates the purulent formation, and affords an exit for the sloughs when loose. Poultices are also applied with advantage.

CARBUNCLE, the beautiful mineral pyrope (which *see*), and the name is also given to a garnet, cut on the under side, and concave on the upper. The light is generally reflected in a flame-like form: hence the name. The clear deep-red garnets from Pegu are most highly valued. (*See* GARNET.)

CARBURETS, *kar'-bu-rets.*—Carburets are now called carbides, the word being more analogous to chloride, iodide, &c.

CARBURETTED HYDROGEN. (*See* HYDROGEN.)

CARBYLE, SULPHATE OF, *kar'-bile*, ethronic anhydrine, so called by its discoverer Magnus. It is a combination of four equivalents of sulphuric acid with one of olefiant gas. (*See* ETHIONIC ACID.)

CARCERULE, *kar'-se-rule* (Lat., *carcer*, a prison), many-celled fruit, each cell being dry, indehiscent, and one or few-seeded, and all more or less cohering by their united styles to a central axis. The fruit of the common mallow is a good example.

CARDAMINE, *kar-de-mine* (from Gr., *kardia*, heart or courage, on account of its strengthening properties), a genus of plants belonging to the natural order *Cruciferæ*. *C. pratensis*, the cuckoo-flower, or lady's-smock, is an indigenous perennial met with in meadows and moist pastures, blossoming in the months of

April and May, when its flowers, which are flesh-coloured, white, or light purple, present a very pleasing appearance. Formerly the flowers were used medicinally, as a remedy in epilepsy. The leaves are antiscorbutic, and are sometimes eaten as watercress.

CARDAMOMS. (*See* ELETTARIA and AMOMUM.)

CARDIA, *kar'-di-a* (Gr., the heart), the superior opening of the stomach, on account of its being situated near the heart.

CARDIACEÆ, *kar-di'-ai-se-e* (Gr., *kardia*, the heart), a family of bivalve *Mollusca*. They have a thick, closed, equivalve shell, with the umbones usually bent round, so that the shell, when seen from either extremity, presents a more or less cordate appearance. The hinge-teeth are strong, from one to three in each valve, and there are usually one or two smaller teeth on each side of the hinge. The animal possesses two adductor muscles. The species of this family are very numerous, and greatly vary in size, some of their shells being remarkable for the smallness and delicacy of their construction. The type of this family is the Cockle. (*See* COCKLE.)

CARDIALGIA, *kar-di-al'-jia*, pain of the heart or stomach. (*See* HEARTBURN, INDIGESTION.)

CARDINAL BIRD. (*See* GROSBEAK.)

CARDINIA, *kar-din'-i-a*, a genus of fossil conchiferæ, with oval or oblong shells. They extend from the Silurian to the inferior oolite, and abound in the "mussel-bands" of clay ironstone. In Derbyshire, vases and other ornaments are turned from these fossils.

CARDIOSPERMUM, *kar-di-os-per'-mum* (Gr., *kardia*, heart, *sperma*, seed, in reference to the shape of the seeds), a genus of plants belonging to the natural order *Sapindaceæ*. The root of the species *C. halicacabum* is diuretic, diaphoretic, and aperient. The leaves are boiled and eaten as a table vegetable in the Moluccas.

CARDITIS, *kar-di'-tis* (Gr., *kardia*, the heart, terminal *itis*), inflammation of the heart. It is characterized by pain in the region of the heart, great anxiety, fever, difficulty of breathing, palpitation, cough, irregular pulse, and fainting. It is applied properly to inflammation of the muscular tissue of the heart itself; but this is a form of disease that rarely occurs alone, being usually accompanied by *pericarditis*, or inflammation of the pericardium, or by *endocarditis*, or inflammation of the lining membrane of the heart. The symptoms and treatment in each case are similar. (*See* HEART, DISEASES OF.)

CARDIUM, *kar'-di-um*. (*See* COCKLE.)

CARDOON, *kar-doon'* (Sp., *cardon*), a garden vegetable, introduced into this country about the middle of the 17th century from the south of Europe. It bears a great resemblance to the artichoke, and belongs to the same botanical genus. (*See* CYNARA.) The tender stalks of the inner leaves, rendered white and crisp by earthing up, are used for stewing, and for soups and salads during the winter. With the florets of the cardoon, called *cardo do coalho*, the Portuguese formerly coagulated milk for cheese-making.

CARDUELIS, *kar'-du-e'-lis* (from Lat., *carduus*, a thistle, on account of their love for the seeds of the thistle), a genus of birds of the Finch tribe. (*See* CANARY, GOLDFINCH, &c.)

CARDUUS, *kar'-du-us*. *See* THISTLE.)

CAREX, *kai'-reks* (Lat., *careo*, I want, the upper spikes being without seeds), a genus of plants belonging to the natural order *Cyperaceæ*, or sedge family, consisting of upwards of 450 species, more than sixty of which are British. The creeping stems of *C. arenaria* and other species help to bind the sands of seashores, and the plants are sometimes carefully cultivated for this purpose on the dykes of Holland. These stems, improperly called roots, have been used medicinally as substitutes for sarsaparilla, under the name of German sarsaparilla.

CARIACOO, *kar'-i-a-koo*, or Virginian deer (*Cervus Virginianus*), a species found in all parts of North America. It is small and of elegant shape, and the colour is variable, being light reddish brown in spring, slaty blue in autumn, and dull brown in winter. The belly, throat, chin, and inner parts of the limbs are white. The horns of the adult male are bent backwards and then suddenly forward, so as to bring the tips nearly above the nose.

ÇARIAMA, *sa-ri-a'-ma*, a bird (*Microdactylus cristatus*) of the order *Grallæ*, nearly allied to the cranes, a native of South America. It is larger than the common heron, and feeds chiefly on serpents, lizards, and insects. The plumage is brown, but whitish on the lower parts.

CARIBOU, *kar-i-boo'*, the American reindeer (*Rangifer caribou*). There are two well-marked permanent varieties inhabiting the fur-countries, one limited to the woody and more southern districts, and the other, known as the barren-ground caribou (*R. Grœnlandicus*), retiring to the woods only in the winter, and passing the summer on the coast of the Arctic ocean. There is a large variety in Newfoundland, Nova Scotia, and New Brunswick, having very large and heavy horns. The colour of the caribou is in the summer a rich, glossy reddish brown, becoming more grizzly, especially about the head, neck, and belly, during the winter. The tail is short, like that of a rabbit, and the hoofs have an immense spread, which gives the animal, when running over soft snow, or a crusted surface, a support almost equal to that of a snow-shoe. The average length of the animal is about six feet, and the height at shoulder three and a half feet. The flesh is said to equal the finest English venison, and the skin is made into clothing, which is almost impervious to cold.

CARICA, *kai'-re-ka* (from being erroneously supposed to be a native of Caria), a genus of plants belonging to the natural order *Papayaceæ*. The species are natives of South America and the tropical regions of the old world. The acrid milky juice of *C. digitata* is said to be a deadly poison. The juice of the unripe fruit, and the powdered seeds of *C. papaya*, are powerful anthelmintics; but the fruit, when cooked, is edible. It is stated that newly-killed meat hung among the leaves soon becomes soft and delicate, and that the flesh of old hogs and old poultry fed on its fruit or leaves is remarkably tender. The leaves are used in some districts as a substitute for soap. The juice is said to be a highly animalized product, resembling animal albumen in its characters and reactions.

CARIES, *kai'-reez* (Lat., rottenness), a disease of the bones analogous to ulceration of the soft parts. Caries most frequently attacks the bones of the spine; but it may affect any of the bones, especially such as are of a spongy texture, as the carpal or tarsal bones, or the heads of the long bones, where they form articulations. The young, or those of a scrofulous habit of body, are most subject to this disease. It sometimes appears spontaneously; at others, as the result of an injury, as a blow or fall. It begins with inflammation, usually attended with a dull, heavy pain and weakness in the part affected. In course of time an abscess forms, which, if not arrested, at length bursts and discharges a thin fluid containing particles of the bone. In caries of the vertebræ, curvature of the spine takes place, more or less, according to the number of vertebræ affected, and paralysis generally sets in. At the articulation of the bones, the part enlarges, the cartilages become affected, and amputation or excision of the joint is often necessary, in order to save the patient's life. Much may be done in arresting the progress of this disease, at least in its earlier stages. For this purpose, the patient should be strengthened by good air and nourishing diet, at the same time that rest is enjoined: the state of the stomach and bowels should also be attended to. In the local treatment of the disease, blisters, leeches, and issues, are to be employed. The abscesses are best left to nature, unless they are productive of much uneasiness. When they have burst, the exfoliation of the diseased part should be expedited as much as possible, so that the healthy portions of the bone may granulate and heal. Caries of the teeth is the cause of that most painful affliction, toothache.

CARISSA, *kar-is'-sa*, a genus of plants belonging to the natural order *Apocynaceæ*. The species *C. Carandas* bears an edible fruit about the size of a small plum, which is eaten in the East Indies, either alone or with meat, as a substitute for red-currant jelly. The fruits of *C. edulis* and *tomentosa* are also eaten in Abyssinia.

CARLINA, *kar-li'-na* (after the emperor Charlemagne, whose army was cured of the plague by it), a genus of plants belonging to the natural order *Compositæ*, and closely allied to the Thistles. *C. acaulis*, the Carline thistle, grows on hills and mountains, especially in calcareous soils, in the middle latitudes of Europe. It was formerly in high repute for the medicinal virtues of its root, which, in large dozes, acts as a drastic purgative; but its use is now confined to veterinary practice. The *C. vulgaris* is the only British species.

CARLUDOVICA, *kar-lu-dov'-e-ka* (in honour of Charles IV. and Louisa of Spain), a genus of plants of the natural order *Pandanaceæ*. The unexpanded leaves of *C. palmata* furnish the material employed in the manufacture of Panama hats.

CARMINATIVES, *kar-min -a-tivs*, certain substances which have the power of dispelling flatulence, or relieving pain in the stomach and bowels. They belong chiefly to the vegetable kingdom; as, cardamoms, peppermint, ginger, and other aromatic stimulants.

CARNATION, a beautiful cultivated flower, a variety of the clove pink. (*See* DIANTHUS.)

CARNATRUBA, OR CARANAIBA, PALM, *kar-na-tru'-ba, ka-ra-nai'-ba* a beautiful species of palm (*Copernicia cerifera*) abounding in the northern parts of Brazil. It is not very tall, averaging about 30 feet, and has a black fruit about the size of an aloe. The leaves have scales of wax on the under part, which is collected and often used to adulterate bees' wax. It is also used in the manufacture of candles, the timber is valuable, and is used for veneer.

CARNELIAN, *kar-ne'-li-an* (Fr., *cornaline*), a term originally applied to a flesh-coloured calcedony, but now applied to blood-red, yellow, white, brown, and nearly black varieties of this mineral. They consist principally of silica coloured by oxide of iron. Bright red carnelians are the most highly valued, but larges tones equal in colour throughout are rare. This word is frequently written and pronounced *cornelian*. The finest carnelians are found in Arabia, India, Surinam, and Siberia. They are sometimes known as Cambay stones, being abundant in the Cambay district of India, where they are worked up into necklaces, bracelets, armlets, seals, chessmen, rings, and other ornamental articles.

CARNIVORA, *kar-niv'-o-ra* (Lat., *caro*, flesh; *voro*, I devour), a term applied to all creatures which feed upon flesh. It is definitely applied to that order of the mammalia which preys upon other animals.

CAROB. (*See* CERATONIA.)

CAROLINA PINK. (*See* SPIGELIA.)

CAROTID ARTERY, *kar-ot'-id* (Lat., *arteria carotidea*). A large artery on each side of the neck. It is so called from the Greek verb *karoo*, I cause to sleep, because, if tied or compressed, the person becomes comatose. The researches of Dr. A. Fleming prove conclusively that there is some connection between deep sleep and the compression of this artery. The right carotid arises from the arteria innominata, the left from the aorta. The left is thus rather longer than the right, and is in general somewhat smaller. They ascend backwards and outwards into the neck, and, when opposite the os hyoides, each of them divides into the external and internal carotid arteries; the former proceeding to the face and parts without the cranium, the latter to those within. The external carotid afterwards divides into ten branches—viz., the superior thyroid, lingual, lateral, occipital, muscular, pharyngea ascendens, posterior auris, transverse facial, temporal, and internal maxillary. The internal carotid enters the cranium by a somewhat tortuous course, and afterwards separates into four branches—the ophthalmic artery, and the anterior, posterior, and central arteries of the brain. A wound of the carotid is generally fatal, although instances have occurred, when by prompt and skilful treatment the artery has been tied and life saved. Sir Astley Cooper first tied the carotid for spontaneous aneurism.

CARP, *karp* (Fr., *carpe*) (*Cyprinus carpio*). This fish is found in most of the lakes and rivers of Europe, and in many places it is cultivated in ponds with great care. It is said to have been introduced into England about the beginning of the 16th century, and it has always been greatly esteemed as a delicate article of food. The carp usually feeds on worms and various insects; this diet, however, in places where this fish is bred, is intermixed with grain, &c. The length of a carp's life is amazing. A century would seem to be about the average; but a healthy fish will occasionally live to the age of 200 years, or thereabouts, its scales becoming white with age. When it is considered that it is an extraordinarily prolific fish, and that its roe has been known to turn the scale against the remainder of the carp out of which it has been taken, and that about 700,000 eggs have been taken from the ovaries of a moderate sized fish, it is, perhaps, fortunate that it is so generally popular as a diet. The carp usually measures about fifteen inches in length; in warm climates, however, it sometimes nearly reaches three feet. The general colour is yellowish-olive; the head is large, and the mouth is provided with two beards, one shorter than the other; the scales are large and very distinct. Its average weight in England seems to be three pounds; but thirty pounds is not unusual in Germany, and one weighing 70 has been taken. The gold fish is a near relation of the carp.

CARPEL, *kar'-pel* (Gr., *karpos*, fruit), a modified leaf, forming the whole or part of the pistil. When several carpels are present, they may be either distinct from each other, as in the columbine, or combined so as to form one body, as in the poppy. The carpels, taken collectively, constitute the *Gynœcium*, or female system of flowering plants. (*See* PISTIL.)

CARPENTER BEE, *kar'-pen-ter* (*Xylocopa*). This species belongs to the *Apidæ*, or true bees. Its name is derived from the singular manner in which its nest is built. This is generally found in soft decaying wood, and is lined with leaves of a semicircular form cut from plants. It is also known as the leaf-cutting bee and upholsterer bee. It is found in all parts of the world.

CARPINUS, *kar-pi'-nus* (Celtic *car*, wood, *pinda*, head, the wood being used for the yokes of cattle), a genus of plants belonging to the natural order *Corylaceæ*, which also includes the oaks, the hazels, the beeches, and the chestnuts. *C. Betulus*, the hornbeam, and *C. Americanus*, yield excellent timber, largely employed for agricultural implements and the cogs of mill-wheels.

CARPOLITES, *kar'-po-lites*, fossil fruits, which cannot be referred precisely to their proper place in the vegetable world. There are about 100 species now known.

CARPUS, *kar'-pus* (Gr., *karpos*), the wrist, or that part of the upper extremity between the forearm and the hand. The carpal bones, or bones of the wrist, are eight in number, and are arranged in two rows—a superior and inferior, each containing four bones.

CARRAGEEN, *kar'-ra-geen*, known also as Irish Moss, a generic term for several species of sea-weed, of the natural order *Algæ*, sub-order *Ceramiaceæ*, of late years it has been recommended for medicinal and dietetic purposes, principally by reason of the notice called to it by Mr. Todhunter of Dublin. The name is Irish, and doubtless the various species have been used by the Irish peasantry for many years. Several varieties are found on the coasts of Ireland, and also on the rocky shores of most parts of Europe and east coasts of N. America. The species principally used is the *Chondrus crispus*, of which there are several varieties. They all contain a large quantity of vegetable jelly, and when soaked in water and then boiled ($\frac{1}{2}$ oz. weed to 3 pints water) and strained, a pleasant drink is obtained. If boiled for a longer time a mucilage is produced which is sometimes used instead of size for house-painting, and which, when cooled, forms a stiff jelly, much valued on account of its demulcent properties. If boiled in a similar way with milk, spices, and sugar, a kind of *blancmange* is obtained which forms a nutritious, pleasant, and digestible food, recommended in cases of pulmonary consumption, and also in cases where iodine would be of value.

CARRARA MARBLE, *kar-ra'-ra*, a beautiful saccharine limestone of great beauty and fine texture, belonging to the Oolitic period. It is obtained from the famous quarries of Carrara (a town in North Italy) which have been worked for more than 2,000 years.

CARRIER PIGEON. (*See* PIGEON.)

CARRION CROW, *kar'-ri-on*, also called *Black Vulture*, a large carniverous bird found in America; a member of the Vulture family, and not a species of Crow as its name might indicate. (*See* CROW and VULTURE.) In this country a crow is commonly spoken of as a carrion crow.

CARRION FLOWERS, the common name given to many species of the genus *Stapelia* natural order *Asclepiadeæ*, because of their remarkably unpleasant smell, which resembles putrid meat. They are natives of Southern Africa, and in appearance are similar to the Cactos family, having thick fleshy stems, very small leaves, and large beautiful flowers.

CARROT. (*See* DAUCUS.)

CARTHAGENA BARK. (*See* CINCHONA.)

CARTHAMIN, *kar'-tha-min*, a red dye obtained from the safflower, or *Carthamus tinctorius*, by digesting it first in weak acetic acid and then in a solution of carbonate of soda, a skein of cotton is placed in the liquid, and lemon-juice or citric acid is added. The colouring matter is removed by the cotton, from which it is washed, redissolved in carbonate of soda, and reprecipitated with citric acid. When dry, carthamin is a red substance, metallic-green when viewed in the mass, but purplish-red when seen in thin layers. Safflower was formerly much used as a dye, particularly in the form of pink saucers, for dying silk stockings; but its fugitiveness is a great objection to its use. Safflower is largely used in the manufacture of rouge for the toilet.

CARTHAMUS, *kar'-tha-mus* (from the Arab., *quortom*, to paint), a genus of plants belonging to the natural order *Compositæ*. The most important species is *C. tinctorius*, the safflower, or bastard saffron. The florets of this yield a beautiful pink dye, and are sometimes used to adulterate hay saffron. The substance called cake saffron consists of safflower and mucilage. The fruits commonly called seeds yield, by expression, a useful oil, which is known in India as Koosum oil.

CARTILAGE, *kar'-ti-lej* (Lat., *cartilago*), is a white, firm, elastic substance, intermediate between bone and ligament, and commonly known by the name of *gristle*. In early life, cartilage in various parts occupies the place of bone, and becomes afterwards ossified. The physical properties of cartilage—its firmness, elasticity, and powers of resistance—render it specially fitted for the purposes which it serves, facilitating the motions of bones or connecting them together.

CARTILAGINOUS FISHES, *kar-ti-laj'-i-nus*, are fishes the skeletons of which are destitute of bony fibre. In some cases, they would almost appear to form the connecting link between the vetebrate and invertebrate animals. The centre of the backbone of the sturgeon is a column of cartilage, and the vertebræ of sharks consist of hollow cones, which have their cups filled up with the remains of a gelatinous cord. In many of the more highly organized cartilaginous fishes, several vetebræ are joined together in one piece, and the skull is formed without sutures, although the shape corresponds with that of other fishes.

CARUM, *kai'-rum* (from Caria, in Asia, it being originally found there), a genus of plants belonging to the natural order *Umbelliferæ*. The species *C. Carui* is the common caraway, a native of most parts of Europe. It is largely cultivated in Essex for its fruits commonly called seeds, which have a pleasant odour and a warm aromatic taste, owing to the presence of about five per cent. of volatile oil. They are much used in confectionery and for flavouring cakes. The oil, obtained by distilling the fruits with water, is used as a corrective adjunct in medicine.

CARUNCLE, *kar'-un-kl* (Latin, *caruncula*, diminutive of *caro*, flesh), a small piece of flesh, or a little fleshy excrescence; hence the *caruncula lachrymalis*, a small fleshy glandiform body, situated on the inner angle of each eye.

CARYA, *kai'-ri-a* (Gr., *karuon*, a nut), a genus of plants belonging to the natural order *Juglandaceæ*. The species are chiefly natives of North America. *C. alba*, the common hickory, is valuable for its timber, and also for its edible seeds, which are commonly known as hickory nuts. *C. olivæformis* yields an olive-shaped or elliptical nut, which resembles the walnut in flavour, and is known as the peccan nut. *C. porcina* yields an edible nut called the hog-nut.

CARYOCAR, *kar-ri-o'-kar* (Gr., *karuon*, nut), a genus of plants belonging to the natural order *Rhizobolaceæ*. The species are large trees, natives of the hottest parts of South America, and sometimes known as Pekea trees. *C. butyrosum* is much esteemed for its timber, which is used in ship-building and for other purposes. The separated portions of the fruit constitute the Souari or Suwarrow nuts of commerce, the kernels of which are delicious. An excellent oil may be extracted from them.

CARYOPHYLLACEÆ, *kai-ri-o-fil-lai'-se-e* (Gr., *karuon*, nut; *phullon*, leaf), the Pink or Clovewort family, a natural order of dicotyledonous plants in the sub-class *Thalamifloræ*. They are mostly herbaceous plants, with stems swollen at the joinings, and opposite, entire, and exstipulate leaves. The flowers are usually hermaphrodite, and the sepals, petals, and stamens exhibit a quaternary or quinary arrangement. The stamens are hypogynous, the anthers innate. The ovary is commonly one-celled, with from two to five styles. The fruit is a one-celled capsule, or rarely two—five-celled, generally with central placents, to which the seeds are attached. The plants of this order are natives chiefly of temperate and cold regions. When found in the tropics, they are generally on the slopes and summits of mountains, often reaching the limits of eternal snow. Lindley gives 59 genera, and 1,055 species. They possess no important properties. Some of the wild species are eaten as food by small animals, and some, particularly the *Vaccarria vulgaris*, are thought to increase the secretion of milk in cows fed upon them. Some of the plants have showy flowers, as the species of *Dianthus*, *Silene*, and *Lychnis*. From plants of the first of these genera are derived all the beautiful cultivated varieties of the sweet-william, pink, and carnation.

CARYOPHYLLUS, *kai-ri-o-fil'-us*, a genus of plants belonging to the natural order *Myrtaceæ*. The most important species is *C. aromaticus*, the clove-tree. (*See* CLOVE.)

CARYOPSIS, *kai-ri-op'-sis*, a one-celled, one-seeded indehiscent fruit, with a thin, dry, membranous pericarp, completely and inseparably united with the seed. The grains or fruits of the grasses, as wheat, barley, rye, and maize, are examples.

CARYOTO, *ka-re-o'-ta* (Gr.), a genus of palms, natives of the East Indies. From the species *C. urens*, sugar, or *jaggery*, is procured, and its juice, when fermented, forms a kind of toddy or palm-wine. The tree grows to a height of about 60 feet, and has a fine appearance. From the trunks of the old trees a kind of sago is obtained, and this is much used as food in Assam.

CASEINE, *kai'-se-een* (Lat., *caseus*, cheese), is the nitrogenous principle of milk, which form, a large portion of the curd. Caseine, in the soluble form, appears to be preserved in solution by a small quantity of alkali contained in the milk. In the coagulated form it is readily obtained by adding dilute sulphuric acid to the milk, which precipitates in the form of a curd. The curd is well washed and dissolved in carbonate of soda, and allowed to stand for twenty-four hours, to let the oil rise to the surface. This is skimmed off and the caseine precipitated by an acid. The process is repeated a second time, and the coagulum digested with alcohol and ether, and dried. With all these precautions the caseine still contains some saline matter, which cannot be removed. It is also obtained by coagulating the milk with hydrochloric acid. Caseine also unites with earthy carbonates and forms insoluble compounds. The efficacy of milk as an antidote in cases of poisoning by acetate of lead, nitrate of silver, and corrosive sublimate, is due to the caseine, which forms insoluble precipitates with those poisonous salts, and so neutralises the poison. The most remarkable form of coagulation is that produced by the action of the secretion from the mucous membrane of the stomach. This substance is called rennet, and consists of the inner membrane of the fourth stomach of the calf, salted and dried. When a solution of rennet is mixed with milk, a dense coagulum is formed, leaving the whey behind, as a thin, clear, straw-coloured liquid. A form of caseine, known as legumin, is obtained from peas, beans, and other leguminous plants, and it resembles the caseine of milk so nearly that the one can scarcely be distinguished from the other, and in China cheese is made from vegetable caseine.

CASHEW NUT. (*See* ANACARDIUM.)

CASHMERE GOAT, *kash-meer'*, a native chiefly of Tibet, in Central Asia, but taking its name from Cashmere, where the well-known and beautiful shawls are manufactured from the fine and silky hair of the goat. The hair is straight and about eighteen inches long, and so fine and light that the fleeces of ten goats are required for the manufacture of a shawl a yard and a-half square. The male animal has very large, flattened, wavy horns. By crossing the breed with the Angora goat (which *see*) a more abundant fleece is obtained.

CASIA, *kai'-se-a*, a shrub (*Osyris alba*) of the natural order *Santalaceæ*. It is above three feet in height, with white flowers and long supple branches. It is very beautiful in appearance, and from the references to it in literature it is known as the "poets' Casia."

CASSAVA. (*See* MANIOC.)

CASSIA, *kash'-e-a* (from Arab., *katsa*, to tear off, the bark being stripped from the tree), a genus of plants belonging to the natural order *Leguminosæ*, sub-order *Cæsalpiniæ*. The leaflets of several species furnish the important drug senna. Some uncertainty prevails as to the species yielding some of the commercial varieties. That kind commonly known as Alexandrian senna is generally supposed to be derived from *C. officinalis*, variety *lanceolota*, and *C. obovata*. This is the kind most esteemed in Britain; but it is frequently adulterated with the leaves of other plants. The common East-Indian, Mecca, or Bombay senna, is by the produce of *C. officinalis*, variety *acutifolia*; Tinnevelly senna, a very fine kind, is furnished by *C. officinalis*, variety. *elongata*. Other commercial varieties are, Tripoli senna, from *C. æthiopica*; Aleppo senna, from *C. obovata*; and American senna, from *C. marilandica*. Another drug, called cassia pulp, or purging cassia, is obtained from a species of this genus; namely, *C. fistula*. The pulp is contained in the pods. It is of a reddish-black colour, with a sweetish taste, and possesses laxative and purgative properties. The pods of *C. Braziliana* are used in veterinary medicine under the name of horse-cassia. The bark of *C. auriculata* is employed for tanning, and the flowers are said to be used for dyeing yellow. The seeds of *C. Absus*, under the names of Chichou and Cismatan, are used in Egypt as a remedy in ophthalmia.

CASSIA-BARK, AND CASSIA-BUDS. (*See* CINNAMOMUM.)

CASSICAN, *kas'-si-kan*, a genus of birds (*cassicus*), allied to starlings. They are natives of America, of gregarious habits, and remarkable for the ingenuity displayed in constructing their nests, by knitting together shreds of bark. The nest is sometimes a yard long and about ten inches wide, and is suspended from the branch of a tree. (*See* ORIOLE.)

CASSIOPEIA, *kas-se-o-pe'-e-a*, a constellation in the northern hemisphere, midway between the constellations Auriga and Cygnus. It is not far from the north pole, and may be distinguished by five stars disposed somewhat in the form of the letter M. It contains only one star above the third magnitude, and that is not so brilliant as stars of the second. It is figured on the celestial globe as a female figure sitting in a chair with its feet towards the pole. The name is said to be derived from Cassiopeia, the mother of Andromeda, who was made a constellation and placed in this position for having boasted that she was prettier than the daughters of Nereus. Tycho Brahe observed a star of great brilliancy in this constellation in 1572, which disappeared in 1574. It is said to have appeared there in 945 and 1264, but this is doubtful.

CASSOWARY, *kas'-so-wa-re* (*Casuarius*), a genus of large and powerful birds closely allied to the Ostrich. The cassowary is an inhabitant of Java and the adjacent Indian archipelago, and is generally called the helmeted cassowary, on account of an osseous crest or horny helmet which surmounts its head. The skin of the head and the upper part of the neck are without feathers, and of an intense blue and deep red colour. There are also two pendent wattles, partly red and partly blue, on the front of the neck. On the breast is a bare place, on which the bird rests when lying on the ground. In height it is less than the ostrich, standing little more than five feet when erect. It is, however, robustly built, and very strong. It is rather timorous and shy, but when attacked defends itself by kicking backwards with its feet, and striking with its short and otherwise useless wings. Its whole plumage is very poorly supplied with feathers, and, at a short distance, it presents the appearance of a rough coat of coarse hair. It feeds upon eggs, fruit, and succulent herbage. The eggs of the cassowary are greenish in colour, and have a much thinner shell than those of the ostrich.

CASSYTHACEÆ, *kas'-se-thai'-se-e*, the Dodder-Laurel family, a small natural order of plants of which there is only one genus—*Cassytha*, which includes nine species, natives of tropical regions, and distinguished from the species of *Lauraceæ* by their parasitical habit, by their scaly modified leaves, and by the fruit being inclosed in a succulent calyx.

CASTANEA, *kas-tai'-ne-a*, a genus of plants belonging to the natural order *Corylaceæ*. The species are familiarly known as chestnut-trees. (*See* CHESTNUT.)

CASTOR. (*See* BEAVER.)

CASTOR OIL. (*See* RICINUS.)

CASTOR AND POLLUX. (*See* GEMINI.)

CASUARINACEÆ, *kas-u-ar-in-ai'-se-e*, the Beefwood family, a natural order of dicotyledonous plants in the sub-class *Monochlamydeæ*. There is but one genus—*Casuarina*, which includes about thirty-two species, principally natives of Australia. They are very peculiar trees, with slender, wiry, drooping, jointed branches, which have no evident leaves. The name Beefwood was suggested by the colour of the timber resembling that of raw beef. The wood is also known under the names of Botany-bay oak, forest oak, he oak, and she oak. It is imported in considerable quantities, and used for inlaying and marqueterie.

CAT, *kat* (*Felis*).—It is not a little singular that the origin of the most important member of this family, the domestic cat (*Felis domesticus*), should be involved in such obscurity. By the older naturalists it was supposed that it might be considered to be descended from the wild cat (*Felis catus-ferus*); but modern naturalists have generally arrived at a different conclusion. It is well known that the ancient Egyptians possessed a domestic animal, which, judging from representations of it on the monuments of Thebes and elsewhere, bore a resemblance to our domestic cat. Moreover, in the British Museum there is a copy of an Egyptian painting, which is supposed to represent the cat of that country catching birds; and it is conjectured that it was trained for that purpose. This same animal has been referred to as being not unlikely the progenitor of the domestic cat; and the probability of this theory has been augmented by the discovery of a species (*Felis maniculatā* by Rüppel in Nubia. This animal is said to be about the size of the domestic cat, and one-third smaller than the wild cat. Rüppel gave his opinion that it must be a descendant of the domestic cat of the Egyptians, and that, at some remote period, it was transferred to the Europeans by the contemporary Egyptians. This opinion, however, has been strongly opposed. The wild cat is found in all the wooded districts of Europe—in Germany, Russia, and Hungary: it is also found in the north of Asia and Nepaul. In Great Britain it was at one time abundant, and met with in all the woods and forests. From a charter granted to the abbot of Peterborough, in the reign of Richard II., we learn that the wild cat was one of the animals hunted in those days. Its hide was probably not very highly valued; Archbishop Corbyl's canons (1127) ordained that the nuns and abbesses should not wear a more expensive apparel than that made of wild cats' or lambs' skins. At the present time, the number of wild cats inhabiting Britain is not very large, and they are principally found in the northern counties, in the mountainous parts of Wales, in Ireland, and more particularly in the north of Scotland. It is the only fierce beast of prey remaining in the British islands. The length of the wild cat frequently exceeds two feet, exclusive of the tail. The fur is soft, long, and thick, and the colour generally grey, with blackish stripes. The domestic cat is so well known that any description of it would be unnecessary. It is of many colours and sizes: there is the black cat, the tabby, the tortoiseshell, the white, the slate-coloured, the blue or Chartreuse, the dun-coloured cat, and a few others, the most beautiful of which, perhaps, is that known as the Angora cat, with its long silky hair. A breed of cats peculiar to the Isle of Man has only a stump of a tail. As a domestic animal the cat is greatly prized, and its services are extremely valuable. It is more attached to locality than to its owner; and there are numerous instances on record of its deserting a family with whom it has been living for years, on their removal from a residence in which it has been brought up, and to which it will return, even though it be under the rule of strangers. Perhaps one of the most admirable qualities of the cat is its extreme devotion to its young; for their sake it will brave the greatest danger, and its uneasiness at finding them removed, only for a few minutes, is familiar to all. The extraordinary artifices it will resort to to secure its young are astounding, and seem almost human in their character. The period of gestation is sixty-three days, the young remaining blind nine days after birth.

CATABROSA, *kat-a-bro'-sa* (Gr., *catabrosis*, a gnawing), a genus of grasses, the leaves of which appear as if they had been gnawed at the points. The *C. aquatica*, growing only in moist situations, is found both in the Old and New Worlds and is very common in Britain. It is a valuable grass, being much relished by cattle. Its leaves often float, and its stalks rise about a foot above the surface of the water. It is known as whorl, or as sweet water grass.

CATALEPSY, *kat-a-lep'-se* (Gr., *katalepsis*, from *kata*, down or into, and *lambano*, I seize), is a disease characterised by a sudden deprivation of sensation and voluntary motion. The attack usually comes on without any warning, and during the paroxysm the patient remains in precisely the same position as he was in at the moment of attack. The circulation and respiration are in most cases but little affected; but occasionally they are greatly depressed, and are sometimes even imperceptible. The attack may last only for a few minutes, or it may continue for hours, and even, it is said, for days; and consciousness generally returns with the same suddenness as it left, the patient having no recollection of anything that passed during the attack. This disease bears a great resemblance to the mesmeric state, and, indeed, is so often feigned that many have doubted whether it really had any existence. There can be little doubt, however, that it is sometimes, though not often, a real disease. The hysterical and melancholic are most predisposed to it; and the paroxysm is frequently induced by some strong mental emotion, or by some disorder of the digestive or secretive organs. The treatment will necessarily vary in each particular case, according to the general condition of the patient and the probable exciting cause. Generally, however, the system should be strengthened by nourishing diet, gentle exercise, sea-bathing, and tonics. During the attack the body should be kept warm and excited by gentle friction; mustard poultices should be applied to the soles of the feet, the palms of the hands, and the pit of the stomach; and strong ammonia applied to the nostrils.

CATALYSIS, *kat-al'-e-sis* (Gr., *kataluo*, I dissolve).—Catalysis, or power of presence, is a term applied to the chemical action that certain bodies exert upon others, without themselves taking part in the chemical changes resulting therefrom. Thus, yeast converts sugar into carbonic acid and alcohol, without itself entering into the composition of either of these bodies. Examples of this occur in many of the ordinary operations of the laboratory.

CATARACT. (*See* EYE, DISEASES OF THE.)

CATARRH, OR COLD, *ka-tar'* (Gr., *katarree*, I flow down), is one of the most common of all the disorders to which the human body is subject, more particularly in variable climates. There are two kinds of this disease—the one a common cold; the other influenza, or epidemic cold. (For an account of the latter, *see* INFLUENZA.) A common catarrh is an inflammatory state of the mucous membranes of the head or chest. In the former case it is called cold in the head, or *coryza*; in the latter, cold on the chest, or *bronchitis* (which *see*). The symptoms of a cold in the head are a sense of uneasiness, heat, and stuffing in the nostrils, diminution or loss of smell, dull, heavy pain in the forehead, inflamed and watery eyes, sneezing, and a slight impediment in breathing. Generally, it extends also to the throat and chest, occasioning hoarseness, cough, and difficulty of breathing. Frequently there is also a general derangement of the system, loss of appetite, lassitude, chilliness, succeeded by dry feverish heats and stiffness of the joints. The nostrils discharge a fluid at first thin and acrid, but which afterwards becomes thicker, and often purulent. The common cause of this disease is exposure to a cold or damp atmosphere, or to draughts, especially when the surface of the body is warm or perspiring. The treatment of a common cold is usually a simple matter. Confinement to the house for a day or two, a warm foot-bath, diluent drinks, abstinence from animal food and vinous or other fermented liquors, and a dose or two of some gentle laxative, are usually sufficient to remove the disease. There is also what is called the *dry* method of cure, which has the advantage of not requiring confinement to the house, though, otherwise, some might be inclined to regard the cure as worse than the disease. It consists simply in abstinence from every kind of drink, no liquor, or next to none, being allowed until the disease is gone.

CAT-BIRD (*Turdus felivox*) a species of American thrush, of the same group as the mocking-bird, which it closely resembles in its vocal powers and its courage in defence of its young. It feeds on fruit and berries of all kinds, worms and insects, and builds its nest in the most conspicuous manner, generally in the neighbourhood of human habitations. It derives its name from its peculiar mewing cry when disturbed in its nest.

CATECHU, *kat'-e-ku* (Jap., *kate*, a tree, *chu*, juice), called *kut* or *kutch* by the natives of India, is properly an extract prepared from the inner brown-coloured wood of the *Acacia Catechu;* but the term is now applied also to other extracts similar in appearance and properties. Some of the catechu of commerce is prepared from the kernels of *Areca Catechu*, and a kind called *Gambir*, or *Terra japonica*, from the leaves of *Uncaria Gambir*. The substance is largely employed in the arts of dyeing and tanning, and medicinally as an astringent. It is imported in roundish balls or square pieces, varying in colour from a pale whitish or light reddish-brown, to a very dark brown. The dark-coloured catechu from Pegu is said to be the most powerful of all vegetable astringents. Catechu contains a large proportion of *tannin*, very similar in properties to that of galls; also a peculiar principle called *catechine*. (*See* ACACIA, ARECA, UNCARIA.)

CATENARY, *kat'-te-na-re*, the curve formed by a flexible homogeneous cord hanging freely between two points of support, and acted on by no other force than gravity.

CATENIPORA, *kat-en-ip'-o-ra*, a genus of fossil corals, peculiar to Palæozoic strata, and in Britain found only in the Silurian measures. They are sometimes known as chain corals; the cells are terminal and oval, and are united together in the form of a hemispherical polypiderm, sometimes of considerable size.

CATERPILLAR, *kat'-er-pil-lar*, the common name given to the larvæ of the lepidopterous insects, butterflys and moths. There is as great a variety in the form of caterpillars as in the insects to which they change. Each family, genus, and species may be distinguished by its characteristics. The bodies of caterpillars are generally long, nearly cylindrical, and divided into thirteen segments, of which the anterior forms a horny head, furnished with jaws and antennæ, and usually with groups of simple eyes. On each side of the body are nine spiracles, or small openings for respiration. The mouth of the caterpillar is usually furnished with strong jaws, capable of tearing, cutting, and masticating the substances on which it feeds, which are very varied in their character, although they entirely differ from the substances eaten by the perfect insect. The first three segments of the body are each furnished with two feet, which represent the six feet of the insect into which they change. All the feet or legs are very short. When the caterpillar has arrived at the proper stage to undergo its metamorphosis, it seeks some secluded spot. Some species find a retreat in the hollows of the barks of trees, others in the walls or wooden palings of the garden, while a few species bury themselves in the earth. Fortunately for the agriculturist, a great quantity of the lepidoptera are destroyed by parasites, which lay their eggs in the larvæ. The caterpillar undergoes two changes, firstly to the pupa state, then to the perfect winged insect. (*See* BUTTERFLY.

CATHA, *katha*, a genus of plants belonging to the natural order *Celastraceæ*. The most important species are *C. edulis* and *spinosa*, two shrubs flourishing in Arabia. The young shoots, with the leaves attached, of these plants constitute the famous drug called *kât*, *khat*, or *kafta*, which is chewed by the Arabs, and is said to produce great hilarity of spirits and an agreeable state of wakefulness. A decoction is also made from it and used as a beverage, like our tea; its effects are described as somewhat similar to those produced by strong green tea.

CATHARTICS, *ka-thar'-tiks* (Gr., *kathairo*, I purify), a term applied to such substances as, taken internally, cause a special irritation of the intestinal canal, and increase the alvine evacuations; in other words, have a purgative effect. Cathartics act upon the system in various ways, and have been variously divided; as, into stimulating, as jalap, aloes, colocynth; refrigerating, as Glauber or Epsom salts; astringent, as rhubarb; emollient, as castor-oil; narcotic, as tobacco or henbane.

Cathartine, also known as "bitter of senna," is the essential principle in senna which possesses purgative properties.

CATKIN, *kat'-kin*, (*Amentum*), a spike of small unisexual flowers, without calyx and corolla, and furnished with scale-like bractæ instead, as in the willow, birch, hazel, alder, oak, and some other trees and shrubs.

CATMINT, *kat'-mint* a plant (*Nepeta Cataria*) of the natural order *Labiatæ*, common on chalky and gravelly soils. It has erect stems, more than two feet high, with whorls of whitish flowers, with pink spots, and velvety heart-shaped leaves. The name is taken from the strange liking cats exhibit for the plant.

CATOPTRICS, *ka-top'-triks* (Gr., *katoptron*, a mirror), that part of optics which treats of the reflection of light from the regularly-formed surfaces of such bodies as water, glass, and the metals. (*See* OPTICS.)

CAT'S EYE, a variety of quartz. It has a pearly appearance, and exhibits a fine play of light; is of various colours, is supposed to be silicified wood, and is obtained chiefly from Malabar and Ceylon.

CATTLE-PLAGUE, OR RINDERPEST, a contagious fever which attacks cattle, generally with a fatal result. It is prevalent on the plains of western Russia (from which it is known as the steppe murrain) whence it has spread, at various times, throughout Europe. Death usually occurs about seven days after the first symptoms appear. There have been many terrible outbreaks in this country, especially during 1865 and the two years following, when about 279,000 animals were attacked, and only 33,400 recovered.

CAUCASIAN VARIETY OF MANKIND. (*See* ETHNOLOGY.)

CAUDEX, OR STIPE, *kaw'-dex* (Lat., *cædo*, I cut, because, by cutting off the branches, what remains constitutes the trunk), in Botany, the acrogenous (summit-growing) stem of a tree-fern. The caudex often rises to the height of fifty or sixty feet, bearing on its summit a crown of foliage. It produces no lateral branches, but is covered with scars produced by the successive whorls of leaves or fronds which have fallen during the life of the plant. The stem is of uniform diameter from near the base to the top.

CAULESCENT, *kawl-es'-ent* (Lat., *caulis*, a stalk), a term applied to plants having evident stems.

CAULIFLOWER. (*See* BRASSICA.)

CAULIS, the term applied to the stem of an herbaceous plant which dies down annually to the surface of the ground.

CAULOPTERIS, *kawl-op'-ter-is*, a term applied to the stem of fossil tree-ferns, found in the Carboniferous and Triassic measures. Twelve species have been described.

CAUSTIC, *kaws'tik* (Gr., *kaustikos*, from *kaio*, I burn), such substances as burn or destroy the skin and flesh by acting chemically upon them. The caustics principally used in medical practice are the nitrate of silver, or lunar caustic, and potassa fusa, common caustic, or caustic potass.

CAUTERY, *kaw'-te-re*, a burning or searing of morbid flesh by a hot iron or by caustic medicines, the former mode being termed *actual cautery*, the latter *potential cautery*.

CAVALCADE, *kav-al-kaid'* (Fr.), a procession or march of persons on horseback; a formal, pompous march or procession of horsemen and equipages by way of ceremony, or as a means of gracing a triumph, or welcoming the public entry of a person of distinction, a victorious warrior, &c.

CAVES, OR CAVERNS, *kaivs, kav'-erns* (Lat., *cavus*, *caverna*, hollow), hollow places in the earth. They occur more or less along the rocky shores of all free-flowing seas, and are the results of abrasion by waves laden with fragments of stone, and acting upon pre-existing fissures or the softer portions of the exposed rocks. The most celebrated caverns, however, occur in limestone strata, and appear to be the results partly of fissuring by subterranean disturbance, and partly of waste by the percolation and passage of carbonated waters. Some are celebrated for their great extent, others for their gorgeous stalactites and stalagmites, and many for their treasures of sub-fossil bones. Among the most remarkable caverns may be mentioned the Mammoth Cave of Kentucky, and others scarcely less stupendous in other parts of America; the caves of Franconia in Germany; of Adelsburg, in Austria; one in the limestone rock at Kirkdale, Yorkshire; those found in the carboniferous limestone of Glamorganshire, in which remains of British pottery have been found, in addition to bones of birds and beasts. In the limestone strata of Derbyshire caverns are found lined with a calcareous deposit of brilliant whiteness, with pieces like icicles of great size hanging from the roof and rising from the floor. These pieces sometimes meet and form columns. Among the Derbyshire limestone caverns, Peake's Hole, near Castleton, Poole's Hole, and the Bagshaw Grottos, are the most remarkable.

CAVY. (*See* GUINEA-PIG.)

CAYENNE PEPPER. (*See* CAPSICUM.)

CAYMAN. (*See* CROCODILE.)

CEANOTHUS, *se-an-o'-thus* (a name given by Theophrastus to a spiny plant), a genus of plants belonging to the natural order *Rhamnaceæ*. The young shoots of *C. Americanus* are used as an astringent, and in New Jersey the leaves are employed as a substitute for tea: hence they are commonly known as New Jersey tea.

CEBIDÆ, *se-bi'-de* (Gr., *kebos*, a species of monkey), a term applicable to all the monkeys of the American continent.

CEBRIO, *seb'-re-o*, a family of coleopterous insects of peculiar structure. The body is of an oblong form, arched above and deflexed in front; the mandibles curved, and entire at the tip. The thorax is broadest behind, and the antennæ generally longer than the head and thorax.

CECIDOMYIA, *se-se-do-mi'-a* (Gr., *kekidion*, a gall-nut; *muia*, a fly), small two-winged flies, that deposit their eggs on the buds of growing plants. The best known is the wheat-fly (*Cecidomyia tritici*), that may be seen in immense masses flying about wheat-fields about June. It is said that they quit the wheatears at the beginning of August, and descend into the earth about half-an-inch below the surface, where they probably remain throughout the winter, making their appearance again in the shape of winged flies when the spring corn begins once more to show its head. There are about 30 British species, all of very small size.

CECROPIA, *se-kro'-pi-a* (after Cecrops, king of Athens, whose legs were fabled to be of snakes), a genus of plants belonging to the natural order *Artocarpaceæ*. *C. peltata*, a tree growing in the West Indies and South America, is remarkable for its stems being hollow except at the nodes. Owing to this peculiarity, the smaller branches are often used for making wind instruments.

CEDAR. (*See* CEDRUS.)

CEDAR-BIRD, *se'-dar* (*Ampelis cedrorum*), or Wax-wing, a native of America. The appellation of Cedar-bird is given to it on account of its partiality to the berries of the cedar. The cedar-bird is largely consumed as an article of food, and at the end of autumn is, owing to its voracity, in prime condition. At this season a great quantity are sent to the markets. The colour of this bird is, on the upper parts, of a fawn-colour; the chin is black, and the abdomen and breast yellow. The wings are slaty-blue; the tail feathers are rich yellow. Round the forehead there is a dark line, covering the eyes. It is about six inches and a half in length, and is rather a slim-built bird.

CEDRELA, *se'-dre-la* (from *cedrus*, the cedar-tree, its wood having an aromatic resinous scent like it), a genus of tropical trees, the type of the natural order *Cedrelaceæ* (the mahogany family) *C. febrifuga*, *C. Toona*, and other species have febrifugal and astringent barks, which have been used as substitutes for cinchona. *C. Toona* furnishes timber resembling mahogany, which is much used in the East Indies, and is occasionally imported into this country under the names Toon, Tunga, Poma, and Jeea-wood.

CEDRUS, *se'-drus* (Gr., *kedros*), the Cedar, a genus of trees belonging to the natural order *Pinaceæ*, sub-order *Abieteæ*. The cedar of Lebanon (*C. Libani*) has been celebrated from the earliest ages for its grave beauty, its longevity, and its magnitude; also for the excellence and durability of its timber. It is often alluded to in Scripture as an emblem of stability and prosperity. The grove of cedars on Mount Lebanon is about three-quarters of a mile in circumference; but of the four hundred trees now standing, there are but twelve of extraordinary age. One of these is 63 feet in circumference, and has possibly been in existence for some two thousand years. The cedar was introduced into England in the latter part of the 17th century. The Deodar, or Himalayan cedar (*C. deodara*), is also a magnificent tree, and is held in great veneration by the Hindoos. The turpentine obtained from this species is much used in India for medical purposes, and is known by the name of *Kelon-ke-tel*.

CELANDINE. (*See* CHELIDONIUM.)

CELASTRACEÆ, *se-las-trai'-se-e*, the Spindle-tree family, a natural order of dicotyledonous plants in the sub-class *Calyciflorœ*, consisting of 30 genera and about 260 species, chiefly natives of the warmer parts of Asia, North America, and Europe, though many are found at the Cape of Good Hope. They are shrubby plants, and are chiefly remarkable for the presence of an acrid principle. The seeds of some contain oil; those of *Celastrus paniculatus* yield an oil used as a medicine in India. Two other species of the typical genus, *C. scandens* and *senegalensis*, have purgative and emetic barks. (*See* CATHA, EUONYMUS.)

CELERY. (*See* APIUM.)

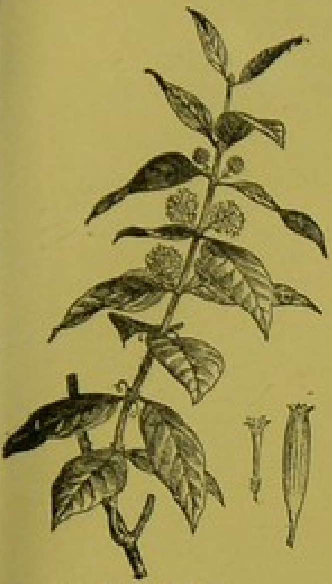
CELESTINE, *sel'-es-tine*, a mineral found in rhomboidal prismatic crystals, consisting of *sulphate of strontia*. It is the commonest mineral of strontia. It is frequently of a beautiful blue colour; but in some cases colourless, or of a red or yellow tinge.

CELLS, *sells* (Lat., *cella*, a cell), in Physiology, are closed vesicles, or minute bags, formed by a membrane in which no definite structure can be discerned, and having a cavity which may contain matters of variable consistence. These cells, remaining as separate corpuscles in the fluids, and grouped together in the solids, persisting, in some cases, with but little change, in others undergoing a partial or thorough transformation, produce the varieties of form and structure met with in the animal and vegetable textures. The embryo animal, as well as the embryo plant, is, in its early stages, entirely formed of cells of a simple and uniform character; and it is by a gradual transformation in the progress of development that some or these cells become converted into the diversified elements of a complex fabric. Every cell owes its origin, in some way, to a pre-existing cell. In plants, the most common mode of multiplication is the subdivision of the original cell into two halves. Sometimes the new cells originate in little bud-like prominences on the surface of the parent cell, which, after a time, become detached and form cells. Cells have ordinarily a spheroidal or rounded shape, but they assume various forms from coming in contact with other cells. Certain of the animal tissues, in their earlier conditions, appear in the form of a congeries of cells, almost entirely resembling the vegetable cells, and in their subsequent transformation pass through a series of changes resembling those that occur in vegetable development. In animals, as in plants, there are two principal ways in which cells may be developed—namely, within the cavity of a previously existing cell, in which case the process is said to be *endogenous*; or in the midst of a plastic fluid, or *blastema*, probably containing cell-germs, which has been prepared or elaborated by cells of a previous generation, but which has been set free by their rupture. The nucleus seems to perform a much more important part in animal than in plant cells, in which, indeed, as a rule, it is absent; and even in animal cells it is often wanting. It is a small round or oval body in the interior of the cell, sometimes lying free, but at other times attached to the cell-wall, and averaging in diameter, in the animal cells, from $\frac{1}{5000}$ to $\frac{1}{4000}$ of an inch. In the conversion of cells into the several tissues, there is in different instances a great difference, not only in the nature and extent of the change which the cells undergo, but also in the condition which these bodies have attained when the process of change commences. In some cases they have already acquired a distinct cell-wall and cavity; in others they never attain the condition of cells strictly so called, and the process of transformation begins while they may be said to be but in a nascent state. The following are the principal modes in which cells or their elements are metamorphosed:—1, Increase in size and change of figure; 2, alteration of substance and of contents; 3, division into fibrils; 4, changes in the relation of cells to each other: 5, formation of membranes and fibres from the blastema, without the intervention of actual cells; 6, changes in the nuclei of cells; and 7, ulterior changes in the blastema. Two or more of the processes here mentioned may occur in the same cell.

CELLULAR TISSUE, *sel'-u-lar*, in Anatomy, is the old name given to what is now commonly known as areolar, reticular, or connective tissue. It is composed of a large number of small transparent fibrils, each about $\frac{1}{25000}$ of an inch in diameter, crossing each other in all directions, and leaving small open spaces. or *areolæ*; whence its name of areolar tissue. This is one of the most extensively diffused of all the tissues of the human body, forming the connecting medium of all the others. It is very sparingly supplied with blood-vessels, and no nerves have been found distributed to it.

In Botany, any vegetable tissue formed of cohering cells alone, and in which there are no vessels. The cells vary much in form and size.

CELLULARES, *sel'-u-la-res*, plants composed of cellular tissue only, forming one of the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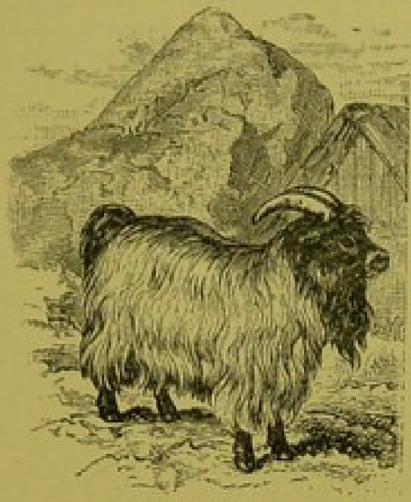
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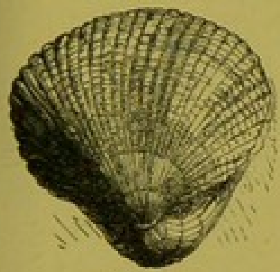
CAMPHOR TREE.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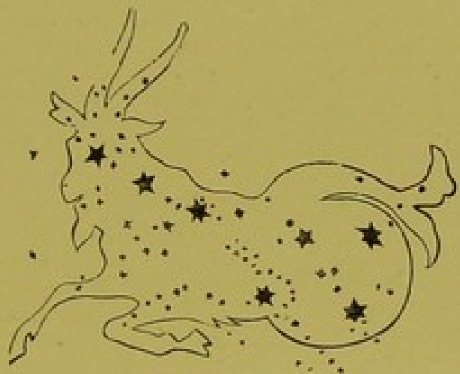
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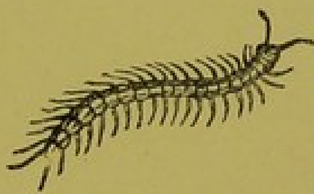
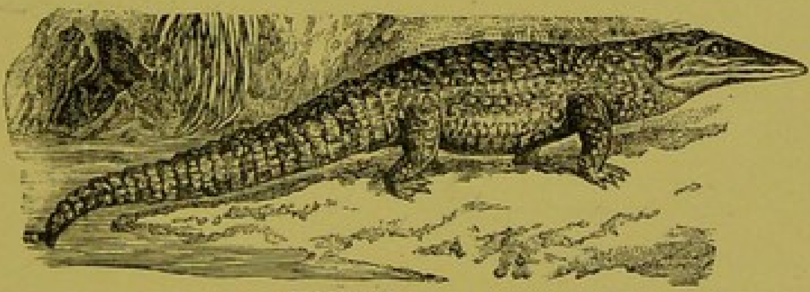

CENTIPEDE.


CHAMOMILE.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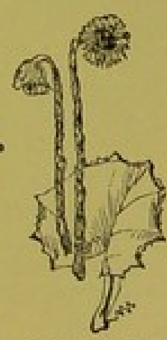

COLTSFOOT.


CHAMOIS.


CALABASH TREE.


COCKATOO.

two great sub-kingdoms in De Candolle's system of classification.

CELLULOSE, *sel-lu-lose'*, the cartohydrates which form the mass of the cell-membranes of plants.

CELOSIA, *se-lo'-si-a*, in Botany, a genus of plants belonging to the natural order *Amaranthaceæ*. Several species have bright-coloured persistent flowers, and are cultivated in our gardens. The best-known is *C. cristata*, the cock's-comb.

CELTIS, *selt'-is*, a genus of trees belonging to the *Ulmaceæ*, or Elm order. The fruit of *C. occidentalis*, which is commonly known as the Sugar-berry or Nettle-tree, has a sweetish, astringent taste, and has been used with some success in dysentery. *C. orientalis* has aromatic properties.

CENTAUREA, *sen-tor'-re-a*, a genus of plants of the natural order *Compositæ*, containing many species, annual and perennial, chiefly natives of the temperate and cold regions of the eastern hemisphere. Some of the British species are weeds; others are ornamental flowers. The common bluebottle (*C. cyanus*), the large bluebottle (*C. montana*), and the star-thistle (*C. calcitrapa*) are familiar plants of this genus.

CENTAURUS, *sen-tor'-us*, a constellation in the southern hemisphere, between those of Lupus and Ara; it contains about thirty-five stars, one of which is of the first magnitude.

CENTAURY, *sen-tor'-e*, a genus of plants (*Erythræa*) of the natural order *Gentianæ*, pretty little annuals with pink and red flowers, natives of the temperate parts of Europe and Asia. A domestic tonic medicine is made from the flowers. The common centaury (*E. Centaurium*), about ten inches high, is most frequent in Britain.

CENTIPEDE, *sen'-te-pede* (Latin, *centum*, a hundred; *pedes*, feet) (*Scolopendra*), a genus of carnivorous *Annulosa*, distinguished by possessing antennæ of fourteen joints or upwards; a mouth composed of two mandibles, a quadrifid lip, two palpi or small feet, united at their base, and a second lip formed by a second pair of dilated feet joined at their origin, and terminated by a strong hook, having an opening beneath its point through which a strong poison is ejected. In the West-India islands and the hotter parts of America the centipede is regarded very seriously as a pest. It attains a length of five or six inches, and very frequently finds its way into beds. The common English centipede is a harmless thing, not exceeding an inch in length, and for the most part hiding under the decayed bark of trees and among old lumber.

CENTRAL FORCES are those forces which cause a body in motion to tend towards the centre of motion. The first law of motion is, that a body must continue for ever in a state of rest, or in a state of uniform and rectilineal motion, if it be not disturbed by the action of an external cause. Upon this law the doctrine of central forces is founded. It therefore considers the external forces which act upon a body in motion when there is an alteration either in its velocity or direction round a central point. It also considers the law of the force by which a body moves round another in a known curve, and solves various mathematical problems. Gravity, as exemplified in the force which acts on all bodies from the centre of the earth, is the simplest and most general example of a central force. Kepler and Newton gave much time and labour to the study of central forces.

Centre of Gravity, *sen'-ter*, a term employed to denote a certain point in the interior of a body, or system of bodies rigidly and invariably connected, so situated that any plane whatever which passes through it divides the body into two segments of equal weight.

Centre of Gyration is that point in a rotating body, or system of bodies, at which, if the whole mass were collected, a given force applied would produce the same angular velocity that it would have communicated to the system in its first condition.

Centre of Magnitude, or Figure, is that point in plane figures and curved surfaces where, supposing their areas had weight, they would balance themselves. Thus, the centre of magnitude of a circle would be its own centre. The same term is applied to any point which bisects all lines that pass through it, and are terminated by the circumference.

Centre of Oscillation is that point in a body oscillating about a fixed axis, into which, if the whole mass were collected, the body would vibrate through a given angle in the same time as in its first condition.

Centre of Percussion is that point in a solid body, or system of bodies, into which, if the whole mass were collected, the greatest possible effect could be produced by striking it against another body. It may also be defined as a point in the axis of a moving body at which, when striking an immovable obstacle, the body rests in equilibrio, without inclining to either side or acting on the centre or axis of suspension.

Centre of Pressure of a fluid pressing against a surface, is that point at which, if a force equal to the pressure were applied in an opposite direction, the surface would remain at rest.

CENTRIFUGAL FORCE, *sen-trif'-u-gal* (Gr., *kentron*, centre; Lat., *fugio*, I flee), is the force that urges a revolving body to fly off in a straight line instead of describing a curve. The moon is held in her orbit round the earth by the opposing *centripetal force* (which *see*), and a stone flies from a sling by centrifugal force.

CENTRIPETAL FORCE, *sen-trip'-e-tal* (Gr., *kentron*, centre; Lat., *peto*, I seek), is the force by which a body in motion is kept revolving round a central point, instead of flying off at a tangent to its orbit; the force opposed to centrifugal.

CEPHAËLIS, *sef-a-e'-lis* (from Gr., *kephale*, head), a genus of plants belonging to the natural order *Cinchonaceæ*. The annulated root of *C. ipecacuanha* is the officinal ipecacuanha of the British pharmacopœias. It is known as *true*, *annulated*, Brazilian, or Lisbon ipecacuanha, and is the only sort commonly met with in this country. It is collected in all seasons of the year, but chiefly from January to March, and is imported from Rio Janeiro, Bahia, and Pernambuco. When given in large doses, it acts as an emetic and as a purgative: in small doses it is expectorant and diaphoretic. Its peculiar properties are principally due to an alkaloid called *emetina*.

CEPHALASPIS, *sef-a-las'-pis* (Gr., *kephale*, head; *aspis*, shield), in Geology, the Buckler-head, a fish of the lower Old Red Sandstone or Devonian period, so called from having the bones of the head united into a single shield-like case. Six species have been described.

CEPHALITIS, *sef-a-li'-tis* (Gr., *kephale*, the head), inflammation of the brain.

CEPHALOPODA, *sef-a-lop'-o-da* (Gr., *kephale*, head; *pous*, foot), a class of molluscous animals, more highly organized than any other, presenting undoubted rudiments of an internal skeleton, and containing secretive, digestive, respiratory, and generative organs. They are also distinguished by the possession of locomotive organs around the head in the shape of prolonged tentacula, which project forward and more or less conceal the mouth. The nautilus, argonaut, cuttle-fish, and similar molluscs belong to this class, represented in fossils by the ammonites and belemnites.

CEPHALOPTERA, *sef-a-lop'-te-ra* (Gr., headwing), a genus of cartilaginous fishes of the ray family. The head is terminated in front by membranes (known as precephalic fins) which roll up and resemble in shape a pointed horn. Only one species of this "hornet ray," the *C. Giorna*, is found on the British coasts. In the Mediterranean, the fish is of great size, one having been known to weigh half-a-ton, and in tropical seas it is much larger.

CEPHEUS, *se'-fe-us*, a constellation of the northern hemisphere, midway between the Polar star and Cygnus, containing 35 stars. The principal star in this group, Alderamin, is of the third magnitude only.

CEPOLA, *sep-o'-la*. (*See* BANDFISH.)

CERAMBYCIDÆ, *se-ram-bi'-se-de* (Gr., *keras*, a horn; *ambyx*, a cup), a family of coleopterous insects, distinguished by the inordinate length of their antennæ. Generally they are of elegant form, and are found in forests and woods, on the trunks of trees, but rarely on flowers. Some of the exotic species are remarkable for emitting after death a scent resembling that of musk. The only scented Cerambycid known in England is the musk beetle (*Cerambyx moschatus*), the odour of which, however, is more like that of roses. It is about an inch long, and of a fine green colour. It is found on willows in the neighbourhood of London. The *C. heros* is one of the largest of European beetles.

CERAMIACEÆ, *se-ram-i-a'-se-a*, a suborder of *Algæ*, also known as Florideæ, seaweeds of a rose or purple colour, with fronds formed of cells arranged in rows. They are very beautiful, and abound in the northern temperate zone. Some of them are used for food, and are of agreeable flavour.

CERASTES, *se-ras'-tees* (Gr., *kerast*, horn), a snake distinguished by two horny protuberances on its head, and hence known as the horned viper. It is said to exist almost entirely without water. The best known species, *C. vulgaris*, is found in the north of Africa, but other species are met with on the western coast, and at the Cape of Good Hope.

CERASUS, *ser'-a-sus*. (*See* CHERRY.)

CERATITES, *se'-ra-tites*, a genus of fossil cephalopoda, found in the triassic strata.

CERATONIA, *ser-a-to'-ni-a*, a genus of leguminous plants of the sub-order *Cæsalpinieæ*. The most important species is *C. siliqua*, the ripe fruit of which is known under the names of carob, locust, St. John's bread, and Algaroba bean. Its pulp has a very sweet taste. The fruit is largely imported into this country for making cattle-food.

CERATOPHYLLACEÆ, *se-ra-to-fil-lai'-se-e*, the Hornwort family, a natural order of dicotyledonous plants in the sub-class *Monochlamydeæ*. There is but one genus, *Ceratophyllum*, the species of which are aquatic herbs, natives of the northern hemisphere.

CERCÉS, *ser'-ses*. (*See* JUDAS TREE.)

CERCOCEBUS, AND CERCOPITHECUS, *ser-ko-se'-bus*, *ser-ko-pith-e'-kus* (Gr., tail-ape). (*See* MONKEYS.)

CERDOCYON, *ser-do'-se-on* (Gr., cunning-dog), a genus of *Canidæ*, intermediate between dogs and foxes, sometimes known as Aguara foxes. They are natives of South America, and those of the coldest parts have a rich fur. They are very cunning, and exhibit a strange propensity to steal and secrete bright-coloured objects, having been known even to carry off gaudy pocket-handkerchiefs.

CEREALIA, *se-re-a'-le-a*, named from the Greek goddess Ceres, the plants which produce grain or corn. They belong to the great order of grasses. (*See* various headings.)

CEREBELLUM. (*See* BRAIN.)

CEREBRIC ACID, *ser'-e-brik* (Lat., *cerebrum*, brain), an acid of a peculiar character found in the brain of animals; also, in smaller quantities in the liver, blood, and nerves. It is composed chiefly of carbon, oxygen, and hydrogen, with small amounts of nitrogen and phosphorous, partly uncombined, and partly in the form of cerebrate of soda. It is a white solid, of a fatty nature, and may be obtained in crystalline grains, which are soluble in boiling alcohol and ether, but insoluble in cold ether. It is insoluble in water, but swells up when left in that liquid for several hours. This acid was formerly called Cerebrin.

CEREBRO-SPINAL FLUID, a fluid of a slightly albuminous character, containing about 1¼ per cent. of solid matters, occupying the space in the brain between the arachnoid and pia mater. (*See* BRAIN.) It affords protection to the nervous centres.

CEREBRUM. (*See* BRAIN.)

CEREOPSIS, *se-re-op'-sis* (Gr., wax-face), a genus of birds of the family *Anatidæ*. The best known species is the New Holland goose, found on the southern shores of Australia.

CERES, *se'-reez*, one of the asteroids that revolve between the orbits of Mars and Jupiter. It was first observed by Piazzi, an Italian astronomer, at the observatory at Palermo, in Sicily, January 1, 1801.

CEREUS, *se'-re-us*, a genus of plants of the order *Cactaceæ*, containing about 100 species, some of which have beautiful flowers. The *C. speciossimus*, with large scarlet flowers and delicious fruit, and the *C. grandiflorus*, with large and fragrant flowers, both American plants, are cultivated in greenhouses.

CERITHIUM, *se-rith'-i-um*, a genus of gasteropodus mollusc, a type of the family *Cerithradæ*. The species are numerous, mostly marine, but some are found in lakes and rivers. They abound chiefly in tropical climates, especially in mangrove swamps. The shell is spiral, elongated, and many-whorled, with an oval oblique aperture. There are many fossil species.

CERIUM, *se'-ri-um*, a very rare metal. It is only known as a grey powder, which becomes lustrous on being burnished. It forms two oxides —the *protoxide* and *peroxide*, which form a few salts of no importance or interest.

CERITE, or OCHROITE, *se'-rite, o'-kro-ite*, is the silicate of cerium, found as a mineral in gneiss.

CEROXYLON, *ser-ox'-e-lon*, or wax palm, a genus of palms. The species *C. audicola* yields wax, which is applied to many useful purposes. It is a native of South America.

CERUMEN, *se-ru'-men*, yellow waxy matter secreted by glands in the passage that leads from the external opening of the ear.

CERVIDÆ, *ser'-vi-de* (Lat., *cervus*, a deer). (*See* Deer.)

CESTOID WORMS, *ses'-toid* (Lat., *cestus*, a hand), a family of *Entozoa*, or intestinal worms, including tape-worms and others of a similar kind. (*See* Entozoa and Tape-worms.)

CESTRACION, *ses-tra'-shun*, a genus of sharks, interesting as the sole surviving relics of the once extensive family *Cestraciontidæ*, the remains of which first appear in the lowest Devonian rocks. They differ from the true sharks in having the mouth at the anterior extremity instead of under the head, and in having the mouth lined with solid bony plates for crushing their victims. The living species include the "nurse," or Port Jackson Shark (*C. Philippi*), and cat shark of the China Sea (*C. Zebra*).

CETACEA, *se-tai'-se-a* (Gr., *ketos*, Lat., *cetus*, a whale), an order of the mammalia, which differs from the rest of that class both in form and habit, and in ordinary language is generally classed with the fishes. All the cetacea have a fish-like form; but the tail fin is horizontal, and not vertical, as in fishes. It is moved by very powerful muscles, and is the great instrument of progression. There are no posterior limbs, and even the pelvis is only represented by two small rudimentary bones. The anterior limbs are in nearly all cases adapted for swimming. The bones, however, in the skeleton appear like those of a hand, but much abbreviated and solidified. The head is joined to the body without any apparent neck, and the upper parts of the vertebræ are consolidated. The skin is naked, and some of the species are conspicuously whiskered. The cetacea are viviparous, and suckle their young, towards which they show great affection. They are warm-blooded, and breathe by lungs, and inhale air at the surface of the water. Fossil cetacea have been found in the Tertiary formation. (*See* Zeuglodontidæ.) The name *Cetotolites* is given to fossil cetacean teeth and ear-bones found in the red crag of Suffolk. (*See* Whale, Dolphin, Porpoise.)

CETOTOLITES, *se-tot'-o-lites* (Gr., *ketos*, a whale, *otos*, an ear, and *lithos*, a stone), fossil cetacean teeth, and ear-bones, belonging to the pleiocene period and found in the red crags of Suffolk. They are valuable as a source of superphosphate manure.

CETRARIA, *set-rai'-re-a*, a genus of lichens which includes the well-known Iceland moss. This lichen, which has been named *C. islandica*, is employed both as a nutritious food and as a mild mucilaginous tonic in catarrh and consumption. Two kinds of starch are found in this lichen—one called *lichen starch*, and the other *inulin*; also a peculiar bitter principle, which has been named *cetrarin*. When used for food only, the plant should be deprived of its bitterness, either by heating it twice in water to near the boiling-point, or by digesting it in a weak alkaline solution, formed by adding half an ounce of carbonate of potash to about a gallon of cold water, and afterwards washing it with pure water. The species *C. nivalis* possesses somewhat similar properties.

CEVADILLA. (*See* Sabadilla.)

CEYLON MOSS. (*See* Gracilaria.)

CEYX. (*See* King Fisher.)

CHÆTODONTIDÆ, (Gr., *chætodon*, hair-tooth), a family of acanthopterous fishes, the typical genus of which, the chætodon, and those most nearly allied to it, have teeth, which resemble the hairs of brushes. Other species, however, have large teeth on the jaws, and palate. The most distinctive character of the family is that all the species have scaly fins. They are brightly coloured in stripes or bands; and most of the species are tropical, but one, *Brama Raii* is found near the rocky shores of the British seas. The flesh is generally of fine flavour.

CHAFER, *tchai'-fer*, a common name of those beetles or coleopterous insects, which, either in the perfect or larva state, are destructive to plants. The word is seldom used alone, but generally as part of a name, with some prefix, as cock-chafer, &c.

CHAFFINCH, *tchaf'-finch* (*Fringilla cœlebs*), one of the most popular of European song-birds. It is about six inches in length, including the tail, which is slightly forked; fore part of the head black; back part, and extending even to the nape of the neck, blue, shading off to an olive-tinted chestnut, and again to a grey-green to the stump of the tail. The tail itself is black and grey, and on each of the two outer feathers there is a peculiar wedge-shaped white spot. From the root of the lower half of the beak to the extremity of the under part of the body the colour is reddish-chestnut. The male may be distinguished from the circumstance of being smaller than its mate, and from the latter's under parts being dingier. The chaffinch lays four or five eggs, of pale purplish-buff colour, sparingly streaked and spotted with reddish-brown. Insects are its chief food, and in the summer season it effects incalculable good by destroying myriads of aphides and caterpillars. In Italy the chaffinch is killed for the table. It is very widely spread, being found in parts of Asia, in the north of Africa, and as far west as the Azores. It is migratory in the cold northern regions; but stationary further south. Linnæus gave the specific name *cœlebs* from observing that in winter, in Sweden, the flocks consisted mostly of males, the females having, as he supposed, sought a milder climate. In France the chaffinch is an especial favourite; and in Germany the "fancy" for the bird amounts almost to a mania. It is greatly sought after by English bird catchers, and caught by means of a decoy bird.

CHAILLETIACEÆ, *shail-le-ti-ai'-se-e*, the Chailletia family, a natural order of dicotyledonous plants in the sub-class *Monochlamydeæ*. The only remarkable member of this family is *Chailletia toxicaria*, a tree growing in Sierra Leone, producing fruit which is called ratsbane from its poisonous nature.

CHAIN RULE. (*See* EQUATIONS.)

CHAIN SNAKE, an American snake, known also as thunder snake and king snake, some specimens of which are four feet long. It is very handsomely marked, with about twenty white bars, so arranged that they have a chain-like appearance.

CHALCEDONY. (*See* CALCEDONY.)

CHALAZA, *tchal-a'-za*, a membrane which unites the nucleus and integuments at the base of an ovule of a plant. The term is also applied to the cords of viscid albumen which bind the yoke-bag of an egg to the lining membrane at the two ends of the shell, and keep it near the middle as it floats in the albumen.

CHALCIS, *tchal'-sis*, a genus of Saurian reptiles, the type of the family *Chalcidæ*, some of which are known as snake lizards, forming one of the transition links between the Saurian and ophidian reptiles they are found in hot climates in both hemispheres.

CHALK, *tshauk* (Lat., *calx*, lime), a variety of limestone, or carbonate of lime, of a soft, earthy nature, generally of a yellowish-white colour, and sometimes pure white. It often forms strata of great size. It has an earthy fracture, is easily broken, and is rough to the touch. Some varieties of chalk are so compact that they can be employed as building-stones when cut or sawn into shape. After being burnt into quicklime, chalk is converted into mortar, in which shape it is much used. Silica, alumina, and magnesia are often present in chalk, and when these are removed by pounding and diffusing in water, it becomes whiting. Chalk is also largely used in the manufacture of soda, for the purpose of decomposing the sulphate of soda in the "balling" process; and it is also used as a manure. (*See* LIME.) Perfectly purified chalk, when mixed with vegetable colouring matters, such as turmeric, litmus, and saffron, forms pastil colours. Vienna white is merely purified chalk. (*See* CRAYON.)

Black Chalk, is a name given to a mineral, which, however, has little resemblance to common chalk. It is of a slatey structure easily cut or broken, and, as it makes a black mark on paper, is used for drawing. It is essentially a kind of clay, and derives its colour from the carbon contained in it.

Red Chalk, is a mixture of clay and oxide of iron. The coarser varieties are used chiefly by carpenters for making marks on wood; the finer sorts are available as a pigment.

CHALK BEDS. (*See* GEOLOGY.)

CHALYBÆUS, *ka-li-be'-us* (Gr., *chalups*, steel), a genus of birds, of beautiful plumage, natives of New Guinea, closely allied to the Baritah (which *see*), but having a thicker bill. The name is taken from the metallic brilliancy of their tints, and the skins are sometimes sold as those of birds of Paradise.

CHALYBEATE SPRINGS, *kal-ib'-e-ait*, natural waters containing iron in solution. They are of two kinds, *carbonated* and *sulphated*. (*See* MINERAL WATERS.)

CHAMA, *ka'-ma*, a genus of molluscs with beautifully marked shells, generally of orbicular form, commonly known as *chams*. They are never found farther north than the Mediterranean. Thirty fossil species are known.

CHAMÆLAUCIACEÆ, *kam-e-law-se-ai'-se-e*, the Fringe-myrtle family, a natural order of dicotyledonous plants in the sub-class *Calyciflora*. This is a small group of shrubby plants only found in Australia, having evergreen dotted leaves. They are nearly allied to *Myrtaceæ*.

CHAMÆROPS, *kam'-e-rops*, a genus of Palms. *C. humilis* (sometimes known as the palmetto), is the only palm found wild in Europe. Fibres obtained from it have been used as a substitute for horse-hair, and in the manufacture of carpets and in Sicily the different parts of this plant are employed for making walking-canes, hats, baskets, and other useful articles. The materials from which the Brazilian chip or grass hats are manufactured are obtained from the species *C. argentea*.

CHAMELEON, *kam-e'-le-on*, a genus of Saurian reptiles constituting a distinct family, with several very peculiar characteristics. They are natives of the warm parts of Europe and Asia, and are very abundant in Africa. The neck is very short, and does not admit of the head being turned; but the eyes are very prominent and possess remarkable powers of motion. The skin is rough, like shagreen. The lungs are very large, and are connected with air-cells among the muscles and beneath the skin, so that the animal has a remarkable power of inflating itself with air. A very curious part of the animal is its tongue, which is composed of a hollow tube, which is terminated by a fleshy knob, and has a cup-like cavity in its anterior surface: this is covered with a glutinous secretion. By a wonderful provision the animal can dart its tongue with lightning-like swiftness and extraordinary sureness of aim at is prey. With regard to its colour-changing propensity of which so much has been said and written, the result of Mr. Milne Edward's investigation is, in substance, as follows:—Beneath the transparent epidermis of this reptile there is a great quantity of minute soft granules, which bear the different colours: these are more or less extended, according to the quantity of blood that reaches them, and the change of colour is thus effected. The changes it really will undergo under certain powerful excitements are from its natural colour, pale grey, through pale green to yellow and dingy red, and sometimes, but rarely, nearly to black. It is said that that lack of nervous co-ordination between the two sides which in most animals is only seen in diseased or defective organizations, is either normal to the chameleon, or easily produced in it. It is even asserted that one side of the reptile may be awake, while the other is asleep. The chameleon is a most sluggish animal, and will sit for hours on the branch of a tree, scarcely giving any token of its existence beyond an occasional roll of its singular eye, for while one eye is quite motionless, the other will protrude from the animal's head, and glare in a hideous fashion. Then, perhaps, suddenly it will dart out its tongue, oftentimes to twice the length of the whole animal, and whisk some unfortunate insect into its jaws. The period of time a chameleon will exist without food is astonishing. Hesselquist makes mention of one he kept for a month, which during the whole time, as far as he could ascertain, did not eat a single insect. Of this genus there are about eighteen species.

In Astronomy, a southern constellation containing nine stars within the antartic polar circle.

Chameleon Mineral.—Manganate of potash was so called from the changes of colour apparent in an alkaline solution of the salt. It is made by fusing binoxide of manganese with carbonate of potash in an open crucible.

CHAMOIS, *sham'-moi* (*Antilope rupicapra*), a species of antelope inhabiting the lofty mountain ranges of central and southern Europe. It is rather larger than the roebuck, and, when full grown, weighs from sixty to eighty pounds. Its colour changes with the seasons. In summer it is of a dusky yellowish brown, and in winter jet black, excepting the head and the hair of the forehead, the belly, and the tufts of hair that overhang the hoofs, which is tawny, and remains so always. The dark stripe, too, extending from the eyes to the mouth is permanent. It has been a disputed point whether the chamois should not be classed with the goat instead of the antelope. Examination, however, shows that there is but little affinity either in the structure of the animals or their habits. The frontal bone of the chamois just before the horns is concave; that of the goat is convex. The horns of the latter recede; those of the former advance, and are perfectly plain and smooth, while the goat's horns are wrinkled. More than all, the chamois is well known to avoid spots favoured by goats; and no instance has ever been shown where a female of either species has brought forth a cross-bred kid. The head of the chamois exhibits in its construction a wonderful blending of lightness and strength. The frontal bones are so fragile that a rap of a man's knuckles would suffice to shatter them—that is, if they were unsupported; but they are supported, and in a marvellous way. Over the first set of bones a second is thrown, and between the walls are arched cells and substantial girders of solid bone. The arched girders which occupy the space between the upper and lower surface rise, bridge-like, with a spiral twist, and here and there a flying buttress will give additional strength to the walls, or a lateral arch help to support the vault above. The horns of the chamois are very curiously constructed. Up to a certain point the horn is hollow, and thence to the point it is dense and solid. The hollow part fits over a bony protuberance growing out of the skull itself. The horns of a full-grown buck measure about seven inches in length, the points being extremely sharp, and hooked backwards. At first sight it would seem that as weapons of attack or defence, the chamois' horns, from their formation, would be next to useless. This, however, is far from the state of the case. When fighting, the chamois lowers his horns under the throat of his antagonist, or turns his head sideways, that the sharp point may come against the shoulder of the enemy, and then, drawing them back vigorously, inflicts a most formidable gash. The horns of the male chamois are thicker and altogether stronger looking than those of the female; they do not diverge from each other in so straight a line as do hers, but describe a slight curve as they rise upwards and apart from each other. The horns of the doe are not so abruptly hooked as those of her mate. Except when running, the gait of the chamois is extremely awkward. The cause is evident. In the first place, its hoofs, shaped like those of the sheep but longer and more pointed, are calculated for sliding rather than for stepping; and, in the second, its hinder legs have every appearance of being longer than the fore. Not only do the hind legs serve as springs, enabling the animal to perform flying leaps from crag to crag, clearing from 16 to 18 feet in a bound, but they break the concussion that would otherwise certainly occur in a leap from a great height, and enable the animal to alight with safety and freedom. A perpendicular wall of rock smooth as glass, and 12 to 15 feet in height, is no impediment to the upward flight of a chamois. He will leap against the slippery wall, and, striking it with its hind feet, obtain a renewed spring, rebound again in an opposite direction to some higher bank, and there find firm footing on a patch so small that a man's two hands could cover it. The food of the chamois consists of such herbs and lichens as grow on the mountains; when, however, the winter sets in so fiercely that every green thing perishes, the animals shift their quarters from the steeps to the woods that grow at their bases, and their subsist on grass and leaves. No animal possesses so tough a skin as the chamois. It will sometimes happen that the hunter's bullet will send one toppling over a precipice nearly a thousand feet deep; but though every bone in its body be smashed by the fall, the hide will remain intact. The skin is made into the famous "shammoy" leather. The hunting of the chamois is a favourite pursuit. The excitement more than counterbalancing the sense of the danger encountered. The flesh is considered a delicacy. The Persian chamois is a smaller variety.

CHAMOMILE. (*See* ANTHEMIS.)

CHAMPIGNON. (*See* AGARICUS.)

CHARACEÆ, *ka-rai'-se-e*, the Chara family, a natural order of acotyledonous plants, in the sub-class *Acrogenæ*—water-plants with distinct stems branching in a whorled manner, sometimes transparent and sometimes coated with carbonate of lime. They occur in stagnant, fresh, or salt water in all parts of the globe, but most abundantly in temperate climates. When in a state of decay, they give off a very fœtid odour, which is considered to be very injurious to animal life.

CHARADRIADÆ, *sha-rad-ri'-a-de*. (*See* PLOVER.)

CHARLES'S WAIN. (*See* URSA MAJOR.)

CHARR, *tsharr* (*Salmo umblas*), a fish of the Salmon family, inhabiting the lakes of Scotland, Wales, and the north of England. The body is longer and more slender than that of the trout; the weight averaging a little over a pound. The back is of an olive colour, speckled with white spots, and the belly red. Its flesh is held in high estimation.

CHAT, *tshat*, a genus of small birds of the order *Sylviadæ*. They are noticeable for their rapid movements in the air. Three specimens, the stonechat, winchat, and wheatear, are British. Chats are found all over the eastern world, and there is a larger bird in America, known as the yellow-breasted chat (*Icteria polyglotta*), but really belonging to the thrush family.

CHATI, *tcha'-te*, a leopard-like cat (*Felis mitis*), a native of South America. It is of small size, and of a yellowish white colour. It prowls about hen-roosts and is very destructive, and is nocturnal in its habits.

CHAVICA, *tshav'-e-ka*, a genus of plants belonging to the natural order *Piperaceæ*, the Pepper family. (*See* PEPPER.)

CHAY ROOT, or SAYAN, a perennial herbaceous plant (*Oldenlandia umbellata*) of the natural order *Cinchonaceæ*, a native both of India, and Mexico. A beautiful red dye is obtained from the bark.

CHEESE-HOPPER, *tshees*, known also as the Cheese-Jumper, or Cheese-Fly. A small black insect of the Beetle tribe, with whitish wings, margined with black. It is furnished with an admirable instrument for depositing its eggs in an ovipositor, which it can thrust out and extend to a great length, so that it can penetrate to a considerable depth into the cracks of cheese, where it lays its eggs, two hundred and fifty-six in number. The maggot is provided with a couple of horny, claw-shaped mandibles, which it makes use of, both for digging into the cheese and for moving itself, being destitute of feet. By bending itself into a circle it can leap to a considerable distance.

CHEETAH, *tchee'-ta*, the hunting leopard (*Feles jubata*), found in Africa, Persia, India, Sumatra, and other islands of the Indian archipelago. It is about equal in size to the leopard, but the body and limbs are longer. It is domesticated, and employed to hunt deer and antelopes.

CHEGOE, or CHIGOE, *tshey'-o* (*Pulex penetrans*), a small black flea, peculiar to South America and the West-India islands, burrows in and under the skin, and there deposits its eggs, the result being the most painful ulcers.

CHEIROLEPIS, *ki-rol'-e-pis*, a species of fossil fish, peculiar to the Devonian measures.

CHEIROMYS, *ki'-ro-mis*. (*See* AYE-AYE.)

CHEIROPTERA, *ki-rop'-te-ra*, (Gr., *cheir*, the hand, and *pteron*, wing), an animal whose anterior toes are connected by a membrane, and whose feet thus serve for wings, as is the case with the bat. (*See* BAT.)

CHEIROTHERIUM, *ki-ro-the'-re-um*. (*See* LABYRINTHODON.)

CHEIROSTEMON, *ki-ros-te'-mon* (Gr., *chier*, the hand; *stemon*, a stamen), in Botany, a genus of trees of the natural order, *Sterculiaceæ*. The species *C. platonoides* is the Hand-plant of Mexico, which derives its common name from the remarkable appearance of its flowers; the anthers and style being so arranged as to resemble a hand furnished with long claws.

CHELIDONIUM, *kel-i-do'-ni-um* (from Gr., *chelidon*, a swallow, the plant being said to flower at the coming, and dry up at the departure of the swallow), the Celandine, a genus of plants belonging to the natural order *Papaveraceæ*. The species *C. majus* is found in waste places and on old walls in this country, and may be recognized by its small yellow flowers, and the orange-coloured juice which exudes from its stem when plucked. This juice is poisonous, and is a popular application for the cure of warts. It has been used with success in the treatment of opacities of the cornea, and has been administered internally as a stimulant.

CHELIFER, *kel'-i-fer*, a genus of arachnida, bearing a close resemblance to scorpions, found in all parts of Europe. These remarkable animals are very small, and have the appearance of miniature tailless scorpions. They run fast, moving forwards, backwards, and even sideways, crab-fashion. They live under stones in crevices of rocks by the seaside. They also find a location in the barks of trees, and among papers and old furniture in houses. They feed upon insects, and are met with in all parts of Europe.

CHELONIA, *ke-lo'-ne-a* (Gr., *chelonia*, a tortoise), in the numerous order of reptiles in which are comprised the tortoises and the turtles. (*See* TORTOISE.)

CHEMISTRY, or CHYMISTRY, *kem'-ist-re* (Gr., *chemeia*).—This science has for its province "to ascertain the nature of the different substances of which the universe is composed, to trace their mutual reactions on each other, to effect new combinations of these components with each other, and to define the conditions on which the combinations existing around us are producible." Mr. Spencer, the author of a popular introduction to the science says, "Chemistry reveals to us the fact that we live in the midst of a vast laboratory, in which changes are perpetually in progress—in which compounds are continually being resolved into their constituent elements, which, in their turn, are destined to unite with other bodies, to form fresh combinations. These changes are not confined to the so-called organic world. It is not under the influence of vital energy alone that the material elements are compelled to combine, in order that they may be assimilated by and incorporated with the living tissue of the animal, or the plant, but we find that constant chemical action is, in like manner, going on in the air we breathe, and in the earth we tread on." The nature and properties of elementary substances, and the changes they undergo when in combination, are the subjects for the investigation of the student of chemistry; and his researches will be chiefly directed to the attainment of two results—the combination of two or more bodies, to form a third body, with properties unlike either of its components; and the separation for a compound substance of the more simple bodies present in it. At present chemists enumerate between 60 and 70 elements, or bodies which have hitherto resisted every attempt to resolve them into anything simpler, which cannot be separated into constituents, and which are consequently regarded as ultimate forms of matter. (*See* ELEMENTS, and the respective headings.) Many of these elements are of very rare occurrence and exist in very minute quantities. The combinations of these bodies are described under BASES, SALTS, ACIDS, RADICLES; while the general laws which regulate their composition will be found under ATOMIC NUMBERS, AFFINITY, SERIES, TYPES, ALLOTROPISM, ISOMORPHISM, ISOMERISM, POLYMORPHISM, &c. Inorganic chemistry treats of the nature and properties of elements and compounds of mineral origin, and organic chemistry of those belonging to bodies of a vegetable or animal nature. Chemistry may be considered under three leading aspects, as a theoretical or a practical, and as an applied science. I. *Pure theoretical, or philosophical chemistry*, is generally subdivided into *organic* and *inorganic* chemistry, although the advance of scientific research is gradually weakening, if not obliterating, the lines of demarcation between the two subjects. In books of instruction, organic chemistry is again divided into *animal* and *vegetable;* and inorganic chemistry into *agricultural*, *medical*, and *metallurgic*. II. *Practical chemistry*—for chemistry is an art as well is a science—which includes the application of theoretical principles to practical purposes—the formation of certain rules and mechanical methods. This, again, has subdivisions, *synthetical* chemistry, which treats of the union of bodies into well defined compounds; *analytical* chemistry, which detects the constituents of a component body, and estimates their quantities. (*See* ANALYSIS). III. *Applied chemistry*, is the application of chemical principles to the various substances used in ordinary life, such a *pharmaceutical* chemistry, which relates to the preparation of substances used in medicine, and *technical* chemistry, which relates to arts, manufactures, and agriculture.

Chemical Formulæ.—The alchemists, for the sake of mystery, employed the signs of the different planets to represent the various metals. Modern chemists, for the sake of convenience and brevity, have given to every element one or two letters called symbols, which are used, in conjunction with figures and algebraic signs, to express every known compound. The letters employed are in general the initials of the English or Latin names of the elements in question; thus, H stands for hydrogen, O for oxygen, K (Lat., *kalium*) for potassium. Two characteristic letters of the name are used when there are two or more elements with the same initial. Thus C stands for carbon, Cl for chlorine, and Co for cobalt. N denotes nitrogen, and Na (Lat., *natrium*) soda. Some familiar metals are marked by the initials or additional letters of the Latin names: thus, Au represents gold (*aurum*), Ag silver (*argentum*), Hg mercury (*hydrargyrus*), and Pb lead (*plumbum*). If a symbol be employed alone, it represents one equivalent in weight of hydrogen which is the unit. (*See* ATOMIC WEIGHT.) Thus, O signifies eight parts by weight of oxygen, that being the equivalent of one part of hydrogen, and C, six parts by weight. When two or more equivalents of one element unite with one or more equivalents of another element, the number of such equivalents is signified by a small figure being placed immediately after the symbol of the element so multiplied; thus MnO_2 (the symbol of black oxide of manganese) represents one equivalent of manganese with two of oxygen. In the formula of a compound substance, the symbol of the metal or its analogue is placed before the symbol of the oxygen, chlorine, or similar elements, as HgCl, the symbol of chloride of mercury. Two symbols, placed side by side, signify that they are in close chemical union: thus, AgO signifies a compound containing an atom of silver united to an atom of oxygen. A comma, separating two or more groups of symbols, must be taken to mean that they are not in such intimate chemical union that the groups cannot be separated without decomposition: thus AgO, NO_5 represents nitrate of silver, which, by certain treatment, can be separated into AgO, oxide of silver, and NO_5, nitric acid. The sign *plus* + signifies that the union is still weaker: thus, $AgO,NO_5 + HO$ means nitrate of silver united to an atom of water, HO. A number placed on the left of a group of symbols signifies that the whole group, as far as the next comma or *plus*, is to be multiplied by it: thus, $KO,2CrO_3$ signifies that one equivalent of potash is united with two of chromic acid. Sometimes the group to be multiplied is inclosed in a parenthesis: $3(HgCy) + 2(KO, SO_3)$ means that three equivalents of cyanide of mercury are united to two of sulphate of potash. Professor Frankland employs thick letters ("Egyptian") for the first symbol of a formula when the element so represented is directly united by points of attachment with the other elements or compound radicals following the first symbol. There are various slight modifications of formulæ which cannot be specified here. Formulæ may be *empirical* or *rational*—the former giving merely the constituents of a compound, the latter indicating the manner in which they are grouped. It is evident, therefore, that a compound can only have one empirical formula, while its rational formulæ are as numerous as the theories of its composition. Alcohol, for instance, is represented empirically by the formula $C_4H_6O_2$. Rationally, it may be represented as the ethylate of water, HO,C_4H_5O; the hydrated oxide of ethyl, C_4H_5O,HO; as a compound of olefiant gas and two equivalents of water, $2HO,C_4H_4$, and so on, *ad infinitum*. Braces are used to denote substitution compounds; that is compounds in which one element, or group of elements, has been substituted for another without materially affecting the character of the compound. Two changes have been lately introduced into chemical formulæ that it will be well to notice—one in which dashes or accents are used to denote the atomic power of the element; the other, a line through a symbol, to signify that its atomic number has been doubled. Bi''' means that bismuth has a triatomic power in the way of forming substitution compounds.

Chemical Nomenclature.—This is based on the great principle that the name of a compound should, as far as possible, express its composition and properties. The names of many of the simple elements we have received from the alchemists, and were formed on no definite plan. Those elements which have been lately discovered have been named either from some characteristic property possessed by them, or from some word indicating their source. Metals, as a rule, terminate in *ium*, as *potassium*, *thallium*, &c.; metalloids in *on*, as *boron*, *silicon*, &c.; gases in *ine* or *gen*, such as *chlorine* and *oxygen*. In several instances theory grounded on insufficient facts has been allowed to influence the name of an element; for example, oxygen was named from *oxus*, acid, and *gennao*, to generate; the theory of Lavoisier, who first adopted a systematic method of nomenclature, being that no acid could exist without oxygen. Subsequently, however, it was found that oxygen occurred in all bases, and that many acids existed that contained hydrogen in its stead. The Lavoisierian nomenclature is founded on the fact that when a compound of two elements is submitted to the action of the voltaic current, these elements separate, one (the electro-positive body) being attracted by the negative pole, and the other (electro-negative body) going to the positive pole. As a rule, it was found that the metalloids were electro-negative and the metals electro-positive. The simplest combinations of two elements are termed binary compounds, and fall naturally into two divisions—bases and acids. Bases always end in *ide*, and are compounds of different proportions of a metal with a metalloid. The proportion of the metalloid is indicated by the addition of a Greek or Latin numerical particle: thus we have the *protoxide*, *sesquioxide*, *binoxide*, and *teroxide* of various metals, indicating that these compounds contain one, one and a half, two, and three doses of oxygen to one of metal. When the metal is in excess, Greek prefixes are used: we have, for instance, the *dinoxide* or *trinoxide* of a metal, showing that the metal is in a double or triple dose. Generally the prefixes *sub* and *per* are used to indicate the excess of metal over metalloid, and *vice versâ*. The termination *uret* was formerly used in several cases, such as *sulphuret*, *phosphuret*, &c.; but it is now abandoned in favour of the termination *ide*. The compounds of the metalloids with each other are named on the same principle. When the proportion of oxygen is large, the compound is generally possessed of acid properties: thus we have Cr_2O_3, the sesquioxide of chromium, which is a base; but, by increasing the oxygen, we obtain CrO_3, which is an acid capable of forming salts with bases. The amount of oxygen contained in oxy-acids is indicated by the termination *ic* for the more highly oxidised, and *ous* for those containing less oxygen, or the prefixes *hypo*, under, or *hyper*, above. A few examples of bases and acids will illustrate this:—

Pb_2O .... Dinoxide or suboxide of lead.
CuO .... Protoxide or oxide of copper.
Fe_2O_3 .... Sesquioxide of iron.
MnO_2 .... Binoxide of Manganese.
AuO_3 .... Teroxide of gold.
PCl_5 .... Pentachloride of phosphorus.
PS_{12} .... Dodecasulphide of phosphorus.
ClO .... Hypochlorous acid.
NO_3 .... Nitrous acid.
ClO_4 .... Hypochloric acid.
NO_5 .... Nitric acid.

Certain metalloids, such as sulphur and hydrogen, combine with other metalloids to form acids: for instance, we have—

HCl .... Hydrochloric acid.
HBr .... Hydrobromic acid.
AsS_5 .... Sulpharsenic acid.
AsS_3 .... Sulpharsenous acid.

The compounds of acids with bases are always indicated by the termination or prefix of the word giving the name of the acid. Acids ending in *ous* and *ic* form salts ending in *ite* and *ate*, the prefix being, of course, preserved. A few samples of this will suffice:—

Sulphate of iron = sulphuric acid + oxide of iron.

Hypophosphate of lead = hypophosphoric acid + oxide of lead.

Sulphate of copper = sulphurous acid + oxide of copper.

Hyposulphate of cobalt = hyposulphurous acid + oxide of cobalt.

When the oxide with which the acid is united is a protoxide or peroxide, the prefixes *proto* and *per* are added; for instance, the pernitrate and protonitrate are the nitrates of the protoxide and peroxide of the metal. When the amount of acid is greater or less than the base, the prefixes *sub*, *sesqui*, *bi*, are used; as the *subcarbonate*, *bicarbonate*, and *sesquicarbonate of soda*. In double salts the name of the base only is repeated; as the *tartrate of potash and soda*. There are a few instances of acids and salts which have the same composition, but different properties. They are distinguished from the ordinary kind by the prefix *meta*; thus we have *phosphoric acid* and *metaphosphoric acid*. The prefix *pyro* signifies that the acid or salt has been obtained by heat; for instance, we have pyrogallic acid, produced in this way from gallic acid. In organic chemistry the nomenclature is in many cases somewhat confused. This is not owing to any want of proper principle in the formation of new words, but rather to the differences of opinion existing amongst chemists as to the composition of the substances indicated. Thus aniline is called *phenylamine phenylia*, and *benzidam*, by different chemists, who each have a theory touching its composition. Organic chemistry may be defined as the chemistry of organic radicles or compounds containing carbon, which act in every way as elements. Organic radicles generally terminate in *yl*, and mostly contain carbon, hydrogen, and oxygen. Thus we have *ethyl*, the radicle of ether, which forms oxides and salts in the same manner as iron, lead, or any of the purely elementary bodies. (*See* ORGANIC RADICLES.) There are also compounds corresponding to the electro-negative bodies *oxygen*, *hydrogen*, *nitrogen*, &c. We have, for instance, *cyanogen* and *amidogen*, which form *cyanides* and *amides*, similar in their properties to *chlorides* and *oxides*. The termination *ol* or *ole* is generally applied to neutral compounds of carbon and hydrogen, possessed of neither basic nor acid properties, and are mostly liquids; such as *benzol*, *pyrol*, *quinol*. The termination *in* is applied to other neutral substances, generally solid; such as *paraffin*, *naphthalin*, and *albumin*. Those ending in *ine* or *ia* are generally bodies allied to the alkalies in their properties. We have, for instance, *quinine* or *quinia*, *strychnine* or *strychnia*, *aniline*, &c., which form salts with acids. Many of those which end in *amine* resemble ammonia, and are considered substitution compounds of that body, in which one or more equivalents of hydrogen are replaced by an organic radicle. If two or three equivalents are replaced, the prefix *di* or *tri* is added to the word; for instance, we have *dimethylamine* and *tripropylamine*, the composition of which is plainly indicated by their names. When the hydrogen is replaced by different bodies, their names are prefixed. We have, for instance, *ethyl-methyl-amylamine*, which consists of one equivalent of nitrogen united to one each of the organic radicles ethyl, methyl, and amyl. There are also substitution acids as well as bases; such as *bromobenzoic acid* and *chloracetic acid*, in which *bromine* and *chlorine* are substituted for an equivalent of hydrogen. Thus, although these names appear unintelligible and unwieldy to the superficial observer, they are as easily understood by the chemical student as any term including several nouns and adjectives would be to an ordinary individual. Foreign chemists have adopted some variations from these general rules; but the representatives of the modern school, in order to obtain uniformity, generally act on the following rule respecting binary compounds, the names of which are formed from the English or Latin name of the positive constituent, with the terminal *ic* preceding that of the negative constituent, which ends in *ide*; thus argentic chloride (silver and chloride) has been substituted for chloride of silver, and plumbic iodide for the older iodite of lead.

Chemistry, History of.—Ancient Egypt was the foremost chemical nation of the East; the glass, pottery, colours, and method of embalming the dead, bearing strong testimony to the fact of the Egyptians being acquainted with chemical processes brought to a great state of perfection. The practical part of the science existed previous to the theoretical; but by degrees, as men began to think, they began also to observe and theorize. Paracelsus (who lived in the early part of the 16th century), though imbued with the fanciful doctrines of astrology and demonology, must be considered as the connecting link between the alchemists and the chemists. He was the first to offer a true chemical explanation of the action of mercury, iron, and lead in the human system. He distinguished alum from copperas, showing that the former contained an earth, the latter a metal. He admitted the existence of other elastic fluids besides air. He was aware that animals could not live, and inflammable matters could not burn, without air. To him succeeded Van Helmont, who was the first to distinguish between aërial fluids, or gases, as he called them. After Van Helmont came Boyle, the founder of the Royal Society, one of the most acute experimentalists that ever lived. His numerous experiments are marvels of accuracy, bearing even the test of our present knowledge. He and his contemporary Hook made great improvements in the air-pump, the invention of Otto Guericke, and paved the way to further discoveries. At the beginning of the 18th century come the names and discoveries of Bechar and Stahl, the founders of the phlogistic theory. They found that by heating charcoal with metallic oxides or calces, they were reduced to a metallic state. They further noticed, that when charcoal was burned it was entirely dissipated. Upon these facts they founded the theory that charcoal, or phlogiston, was a principle which united with the calx to form the metal. This theory, which was the first general principle applied to the whole range of chemical phenomena, maintained its ground for some time until the discoveries of Priestley tended to overthrow it, by proving that the calx, or oxide, of mercury, instead of gaining something by being heated, lost something, and that that something was oxygen. About this time Cavendish discovered hydrogen, and Rutherford nitrogen, experiment being heaped on experiment, and discovery on discovery, until the Stahlian theory gave way. It was succeeded by that of Lavoisier, the father of modern chemical science, who classified and arranged the known chemical facts into a system unparalleled for its precision, extent of view, and logical accuracy. His discoveries were few, but he reasoned on the discoveries of others with wonderful astuteness. From this moment chemistry marched onward with giant strides. Berthollet, Fourcray, Vanquetin, Klaproth, Richter, and other foreign chemists, greatly advanced the science; and the application of the Voltaic current to the decomposition of the alkalies, by Davy, resulted in the discovery of a dozen or more new metals. The atomic theory of Dalton threw great light upon the composition of salts and acids. The invention of the symbolic notation by Berzelius, and the determination of the elementary equivalents soon followed. In 1811, Davy overthrew the notion of Lavoisier, that acids could not exist without oxygen, by proving that hydrochloric acid consisted only of chlorine and hydrogen. In 1812, Courtois discovered iodine; Balard followed some time after with bromine. Element succeeded element until they reached the number of sixty. All this time organic chemistry was making great progress. The vegetable alkaloids began to attract great attention; their analyses were made, and new theories founded on them. The early labourers, Liebig and Berzelius, threw great light on this branch of the science, which is even to this day the most attractive to many famous chemists. Gay-Lussac and Thenard contributed greatly to the knowledge of organic substances, and the chemical nature of heat. The development of the theory of organic radicles has gone on increasing, fostered by the labours of Faraday, Laurent, Gerhardt, Hofmann, and a host of others, until it has assumed a mathematical precision unknown to any other branch of physical science. The investigations of organic compounds by these philosophers have resulted in a complete change, both in the notation and nomenclature of mineral substances. This theory, which was founded by Gerhardt, will be fully explained under GERHARDT'S THEORY. The last great discoveries have been spectral analysis, which has resulted in the addition of three new elements to our already bulky list—*cæsium* and *rubidium*, by Messrs. Bunsen and Kirchoff, of Heidelberg, and *thallium*, by Mr. Crookes, a distinguished English analytical chemist. The researches of Graham upon the diffusion of salts in solution and in dialysis, or the separation of crystallizable and non-crystallizable substances in solution by means of an intervening diaphragm, are amongst the most brilliant discoveries of the age. The researches of Schönbein, Schroetter, Brodie, and others, on the allotropic states of bodies, seem to point to the compound character of the present elementary bodies. In fact, chemistry at the present day is making such enormous strides, that its advance can only be properly studied in the current scientific journals.

Chemical Societies.—The Chemical Society of London was established in 1841; that of Paris in 1857; that of Germany at Berlin in 1867. The Institute of Chemistry of Great Britain was formed in 1877; and the Chemical-Industrial Society in 1881.

CHEMNITSIA, *kem-nit'-ze-a*, a genus of gasteropodus mollusca, having slender, elongated, many-whorled shells. They are found in various parts of the world, and about 180 fossil species have been described.

CHENOPODIACEÆ, *ke-no-po-de-ai'-se-e* (Gr., *chen*, a goose; *pous*, a foot), the Goosefoot or Spinach family, a natural order of dicotyledonous plants, in the sub-class *Monochlamydeæ*. There are 72 genera, which include 510 known species, distributed over all parts of the globe, but most adundant in extra-tropical regions. Several plants of this order inhabit salt-marshes, and yield by combustion the soda-ash called *barilla* (which *see*). Many are esculent; as beet and mangold-wurzel (*see* BETA), spinach (*Spinacia oleracea*), garden orach (*Atriplex hortensis*), and English mercury. (*See* CHENOPODIUM.) The seeds of others are nutritious. Several contain volatile oil, which renders them anthelmintic, antispasmodic, aromatic, carminative, and stimulant.

CHENOPODIUM, *ke-no-po'-de-um*, the typical genus of the natural order *Chenopodiaceæ*. The seeds of *C. Quinoa* contain starch granules, which are remarkable for being the smallest hitherto noticed. They are known under the name of *petty rice*, and form a common article of food in Peru. *C. bonus Henricus* ("good Henry") is the English mercury, a plant formerly much used as a pot-herb. The seeds of *C. anthelminticum* (wormseed) are largely employed in North America for their anthelmintic and antispasmodic properties. *C. vulvaria* (stinking goosefoot), an indigenous plant, is a popular domestic remedy for female complaints. *C. ambrosioïdes* is employed in Mexico and Columbia as tea; hence it is commonly known as Mexican tea.

CHERIMOYER, *ker-e-moi'-er*, the name commonly given to the fruit of the *Anona cherimolia*. It has been described as the finest of all fruits, and is generally eaten for dessert by the wealthy inhabitants of Peru and Brazil. It is sometimes called the cherimolia. (*See* ANONA.)

CHERRY AND CHERRY LAUREL. (*See* CERASUS.)

CHERT, *tchert*, a variety of quartz, common in the mountain limestone, oolite, and green sand formation, the coarser kinds being sometimes known as hornstone. The name chert is also given to the silicious concretions which occur as nodules and layers in limestone rocks, like flints in the chalk.

CHERVIL. (*See* ANTHRISCUS.)

CHEST. (*See* THORAX.)

CHESTNUT. (*See* CASTANEA.)

CHEVRETTE. (*See* GYN.)

CHICKEN-POX, *tshik'-en-pox*, the name given to an eruptive disease, usually of a mild nature, and bearing some resemblance to small-pox. It is mostly confined to children, and is of a contagious nature. The premonitory fever is very slight, and the vesicles are filled with a watery fluid, rarely with yellow matter or pus, and pass away in the course of four or five days, leaving only slight crusts or scales, which fall off without leaving any permanent mark. The disease is rarely attended with danger, and, generally, all that is necessary is to put the patient upon spare diet, and to administer a dose or two of some mild aperient.

CHICK-PEA. (*See* CICER.)

CHICK-WEED. (*See* STELLARIA.)

CHICORY, OR SUCCORY. (*See* CICHORIUM.)

CHIFF-CHAFF, a sprightly little bird, *Sylvia hippolais*, so named from its note; common in the south of Europe, but in Britain a bird of passage.

CHILBLAIN, *tshil'-blain* (Ang.-Sax., *chill*, cold; *blain*, a pustule or blister), is an inflammatory affection of the skin, occasioned by exposure to sudden alterations of heat and cold, and usually affecting the hands or feet. Young persons are more subject to it than adults, and females than males. The part is red and swollen, and is attended with heat and a great sense of itching. Chilblains are generally produced by persons holding their hands or feet to the fire immediately after they have been exposed to great cold. The itching is best removed by frequently rubbing the part with some stimulating application, as camphorated spirits of wine. If the parts should ulcerate, it is often very difficult to heal; but the best application to use is spermaceti ointment.

CHILLIES. (*See* CAPSICUM.)

CHIMÆRA, *kim-e'-ra*, a genus of cartilaginous fishes bearing some resemblance to the sturgeon, but now regarded as the type of a distinct family. The only known species is the *C. monstrosa*, found in high latitudes, and commonly known as "the king of the herrings," from its habit of pursuing the shoals. It is about three feet long, silvery white, in general colour, but on the upper part mottled with brown spots.

CHIMPANZEE, *tshim-pan-zee'* (*Troglodytes niger*), a species of ape, and one which in form and structure exhibits the greatest resemblance to man. It is a native of the warmest parts of Africa, and seldom attains a height exceeding four feet when in an erect position. Its skin is thickly covered with long black hair in front; and on the head, back, and limbs the hair grows thicker than elsewhere. The ears are thin, prominent, and naked, and not unlike human ears in shape. The appearance of the nasal organ is that of a mere pucker in the skin. The thumb of the hand is small and weak; that of the foot remarkably large and powerful. The great toe of the chimpanzee is shorter than the other toes, and opposed to them as a thumb.

The most man-like of this genus, however, is undoubtedly the gorilla. (*See* GORILLA.) The chimpanzee differs from the ourang-outang in having a cranium broader in proportion to its face, in eight more minute distinctions as to the characteristics of the skull; in the smaller size of the incisor and canine teeth, and inferior development of the jaws, giving it a more human and less beast-like head, in the possession of an additional dorsal vertebra, an additional pair of ribs; and in many other points relative to the conformation of the chest, loins, fingers, &c., amounting altogether to twenty points of difference.

CHINA BARK, a common name for cinchona. The name has nothing to do with China, but is derived from Kina or Quina, the Peruvian name of cinchona china.

CHINA ROOT, the rootstock of a shrub of the sarsaparilla kind, a native of China, Cochin-China, and Japan. It abounds in starch, is sometimes used as an article of food, and in medicine as a diaphoretic.

CHINCHILLA, *tshin-tshil'-la*, a small rodent animal, chiefly valuable for its fur, which is beautifully soft, downy, and of considerable length, but so loosely attached to the skin, that it falls off unless handled with considerable care. It associates in numbers, and excavates burrows, in which it resides, feeding chiefly on roots. In size and general form it resembles the rabbit, excepting the tail, which curls over, after the fashion of the squirrel's. It is a native of South America, and inhabits the valleys of the high mountain districts. The length of the body is about nine inches, and that of the tail five.

CHINESE GRASS. (*See* BŒHMERIA.)

CHIOCOCCA, *tchi-o-kok'-sa*, a genus of plants of the natural order *Cinchonaceæ*, *C. densifolia*, a bushy shrub, a native of Brazil, is in great favour as a remedy for snake-bites. An infusion of the bark is occasionally used in medicine as a drastic and emetic, but only in extreme cases and in small doses, so violent are the effects produced.

CHIQUICHIQUI, PALM, *tché'-ke-tché'-ke*, one of the plants which yield the Piassaba fibre of Brazil, so commonly used in brushmaking. It is the *Leopoldinia Piassala*, and grows in swampy land on the banks of rivers in the north of Brazil. The leaves, which are very large, are used for thatching.

CHIRATA, OR CHIRETTA, *tchi-ra'-ta*, a plant, *Agathotes Cherayta*, or *Ophelia Chirata*, of the natural order *Gentianeæ*, a native of the mountains of the north of India. The herb and root are both intensely bitter, and are used by European practitioners in India as a tonic and febrifuge.

CHIRU, *ki'-ru*, a species of antelope, *Antelope Hodgsoni*, a native of the pine-forests and elevated plains of Tibet. It is larger than the chamois (*see* CHAMOIS), lives in great herds, and is remarkable for watchfulness against the approach of danger.

CHITIN, *tchi-tin*, a white amorphous body, which forms the skeleton of crustaceans, and the skeleton scales and trachea of insects, and even forms one of the layers of the intestinal canals. In making preparations for the microscope, insects are treated with a solution of potash, which dissolves all but the chitin, leaving the most delicate parts exposed to observation.

CHITONIDÆ, *ki'-ton-i-de*, a family of gasteropodus molluscs, occupying a place in systematic arrangements close to limpets. The shell is composed of eight narrow transverse calcareous pieces, overlapping each other in a row along the back, and strongly attached to the fleshy and fibrous mantles. These molluscs have the power of rolling themselves up into a ball. More than 200 species are known; some of the foreign species are three or four inches larger, but those found on the British coasts are smaller.

CHIVE, *tchive*, a plant of the genus Allium (which *see*), cultivated in kitchen gardens, and the young leaves of which are used for flavouring. It averages nine or ten inches in height, has small flat clustered bulbs, and has red or flesh-coloured flowers. The plural form of the name, "chives," is generally used.

CHLAMYDOSAURUS, *kla-mi-dos-au'-rus* (Gr., *klamudos*, a cloak, and *sauros*, a lizard), commonly known as "the frilled lizard," a singular genus of reptiles, marked by a large plaited frill on the neck. The best-known species is the *C. Kingii* of Australia. It is nearly three feet long. When at rest, the frill lies back in plaits upon the body.

CHLAMYPHORUS, *kla-mif'-o-rus* (Gr., *klamus*, a cloak), a small mammal of Chili, which appears to form a connecting link between the edentates and the insectivora. The native name is "pichiciago;" the name now adopted by naturalists indicates the long covering of the top of the head and back, consisting of 24 rows of plates of thick skin. The lower parts are covered with soft fur. The animal is five or six inches long, and lives underground like the mole, which in many respects it resembles.

CHLORANTHACEÆ, *klo-ran-thai'-se-e* (Gr., *chloros*, green; *anthos*, a flower), a small natural order of dicotyledonous tropical plants, in the sub-class *Monochlamydeæ*, consisting of about fifteen species, which are arranged into three genera. The typical genus *Chloranthus* includes some useful species. The roots of *C. officinalis* and *brachystachys* have been employed in Java as stimulants in malignant fevers, and for their antispasmodic effects. The leaves of *C. inconspicuus* are used in China to impart to tea what is known as the "cowslip flavour." Aromatic stimulant properties are common to all the plants of this order.

CHLORINE, *klor'-ine* (Gr., *chloros*, green), a transparent gas of a greenish-yellow colour and a powerfully suffocating odour, which, even largely diluted with air, produces great irritation of the air-passages. It is prepared by oxidising hydrochloric acid by heating it with binoxide of manganese. One hundred cubic inches weigh between 77 and 78 grains. It is, therefore, about two and a half times heavier than atmospheric air. The symbol (*See* CHEMICAL NOTATION) is Cl, the specific gravity 2·411. Water absorbs about twice its volume; it can, therefore, be only collected by displacement or over warm water. Under a pressure of four atmoshperes it condenses into a yellow limpid liquid, rather heavier than water, and remains fluid and unfrozen at a temperature of 220° Fah. With water, *chlorine* forms a definite hydrate, which, when subjected to a cold of 32° Fah., solidifies in the form of large yellow crystals. Chlorine is not combustible, but supports combustion to a certain degree. A wax taper burns in it with a reddish smoky flame, the hydrogen of the wax combining with the chlorine to form hydrochloric acid, and the carbon being set free. Chlorine, in common with several other elementary bodies, has the property of replacing hydrogen in its organic compounds. It is in this manner that chlorine bleaches textile fabrics. The brownness of the fabric is due to some brown organic substance, which, when submitted to the action of chlorine, parts with its hydrogen and assumes a colourless form, containing chlorine. This fact is proved on a large scale by the action of chlorine on indigo. Another property of chlorine is that of destroying noxious vapours and miasmata. For the same reason, it is used as a disinfectant, the action being the same as that mentioned above. Chlorine is possessed of powerful affinities, and unites with all the metalloids and metals. With hydrogen it forms hydrochloric acid, and with nitrogen a fearfully explosive substance—perchloride of nitrogen. With carbon it forms several chlorides. (*See* CARBON.) The oxygen compounds of chlorine are *chloric acid*, *chlorous acid*, *hypochlorous acid*, *perchloric acid*, and other oxides of unimportant properties and less definite composition.

Chloric Acid is a colourless syrupy liquid, very powerful as an oxidising and bleaching agent. With bases it forms well defined salts, the most important of which are *chlorate of barium* and *chlorate of potassium*, which are decomposed by heat with evolution of oxygen, and detonate when heated with combustible bodies. Chlorate of potassium is largely used as a source of oxygen gas, as an oxidising agent in calico-printing, and in the manufacture of lucifer matches, fireworks, and percussion caps.

Chlorous Acid is a yellowish-green gas, which, with bases, forms some unimportant salts.

Hypochlorous Acid is a pale reddish yellow gas, with an odour strongly resembling that of chlorine. When slightly heated, it decomposes with explosives, and unites with bases to form salts, three of which, *calcium*, *sodium*, and *potassium salts*, are of great use as bleaching substances and disinfectants.

Perchloric Acid, a colourless, oily liquid, very volatile and easily decomposed. It is the most powerful oxidising agent known; a single drop brought into contact with charcoal, or other combustible body, induces combustion with explosive violence. It unites with bases to form well defined salts, the most important of which is *perchlorate of potassium*.

CHLORINE, SPECTRUM OF.—Chlorine absorbs the coloured portion of the spectrum where the coloured rays are most abundant. (*See* SPECTRUM.) Absorption lines are distinctly visible in the spectrum of light which has traversed a tube filled with chlorine.

CHLORITE, *klo'-rite*, a mineral of a green colour, consisting of silica, alumina, magnesia, and protoxide of iron. It is sometimes found foliated like talc, and more rarely in hexagonal crystals; is soft and easily broken.

Chlorite-Schist, a green slatey rock, in which chlorite is abundant, usually blended with minute grains of quartz, or with felspar or mud.

CHLOROPHYLL, *klo'-ro-fil*, the green colouring matter of leaves. In the purest state in which it has been obtained it is a dark green powder, unaffected by any heat below 392° Fah., insoluble in water, but dissolved by alcohol, acids, and alkalies. Light is indispensable to its formation.

CHLOROPS, *klo'-rops*. (*See* CORN-FLY and WHEAT-FLY.)

CHLOROSIS, *klo-ro'-sis* (Gr., *chloros*, green), is the name of a disease to which young females are subject, and which is characterized by a peculiar sallow, or greenish-yellow, hue of the countenance, and hence known as the green sickness. It occurs at the age of puberty, and is connected with the development of the female constitution. The principal means to be employed in the cure of this disease are gentle exercise, nutritious and rather stimulating diet, tonics, and sea-bathing. The term is also applied to a diseased state of plants, in which a greenish-yellow hue takes the place of the natural colour.

CHLOROSPORÆ. (*See* ALGÆ.)

CHLOROXYLON, *klo-roks'-e-lon* (Gr., *chloros*, green; *xulon*, wood), a genus of tropical trees belonging to the natural order *Cedrelaceæ*, or Mahogany family. All the species have dotted leaves, which yield by distillation an essential oil. *C. Swietenia* furnishes Indian satin-wood, which is sometimes imported into this country for the use of cabinetmakers.

CHOCARD, OR CHOQUARD, *tcho'-kard*, a genus of birds, *Pyrrhocorax*, of the crow family. The only European species is the Alpine crow, which is about the size of a jackdaw, of a brilliant black colour, with yellowish bill and red feet.

CHOKE-DAMP, *tshoke'-damp* (Ang.-Sax.), a name given by miners to carbonic acid, as distinguished from fire-damp, which is carburetted hydrogen.

CHOLERA, *kol'-e-ra*, (Gr., *chole*, bile, and *rheo*, I flow), the name given to two or three different forms of disease, each of which is characterised by vomiting and purging, with great pain and debility. The mildest form of this disease is known as *bilious* or *British cholera*, and usually prevails to a greater or less extent in this country every summer or autumn. It apparently proceeds from some disordered condition of the bile, which is either in excess or too acrid, and seems to be produced by cold, suppressed perspiration, unripe or acid fruits, &c. It generally commences with griping pains of the bowels, followed by vomiting and purging, together with heat, thirst, a hurried respiration, and a frequent but weak and fluttering pulse. In favourable cases these symptoms subside in a few days, leaving the patient in a very weak and exhausted condition; but in severe cases great depression of strength ensues, attended with great anxiety and lowness of spirits, violent spasms, cold, clammy sweats, a hurried and short respiration, hiccup, a low and irregular pulse, and the patient sinks rapidly, being sometimes carried off in twenty-four hours. In the earlier and milder form of this disease, when the strength is not much exhausted, tepid demulcent liquids are to be frequently administered, so as to lessen the irritation and facilitate the discharge of the bile. Where the symptoms are severe and the patient rapidly sinking, opium is to be administered freely, but in small quantities, and effervescent saline draughts given to check the sickness, and enable the stomach to bear the frequent doses of opium. When the urgent symptoms are relieved, the strength is to be restored by gentle tonics and a light and nutritious diet.

The severer form of this disease is sometimes called spasmodic cholera, from being usually attended with violent spasms. The *Asiatic*, *malignant*, or *pestilential cholera*, is a much more violent form of disease, and first became known in this country in the autumn of 1831. It is epidemic, commonly comes on without any warning, and the patient is frequently a corpse in a few hours. The attack usually begins with sickness and purging; the discharge in this case not being bilious, but a thin colourless fluid like rice-water, accompanied with great prostration of strength and cold clammy sweats. In a short time dreadful cramps assail the extremities, and afterwards the abdomen and other parts of the body; the body becomes bent, the limbs twisted, the countenance cadaverous, the pulse almost imperceptible, the eyes sunken and surrounded by a dark circle, the patient sinks into a state of apathy, and, unless a favourable change speedily takes place, he soon expires. When reaction takes place, the pulse gradually returns, the natural warmth of the body is restored, and the spasms and difficulty of breathing give way. Frequently, however, the reaction is accompanied by fever closely resembling typhus, and which often terminates fatally, in from four to eight days. As regards the treatment of this disease, the only advice that can be given here is to seek the aid of a medical man without delay.

CHONDRUS, *kon'-drus*, a genus of *Algæ*. The most important species is *C. crispus*, commonly called carrageen, or Irish moss, which is used medicinally for its nutritive, emollient, and demulcent properties, being administered in the form of a decoction or jelly. It is also used for making *bandoline* (which *see*), and as a substitute for size. *C. mamillosus*, which has similar properties, is always found in the carrageen moss of the shops.

CHONETES, *ko'-ne-tes*, a genus of fossil brachiopodus mollusca, of which 29 species have been found, in the pantæozoic formation.

CHORD, *kord* (Lat., *chorda*), in Geometry, is a right line drawn from one part of an arc of a circle to another.

CHOREA, *kor-e'-a* (Gr., *choreia*, a dancing or jumping), is the name of a disease otherwise known as St. Vitus's Dance, and characterised by convulsive motions of the limbs, as of a person dancing. The muscles of voluntary motion are no longer under the complete control of the will, and the power of walking or of using the arms or hands is impaired. It is common to both sexes; but rarely attacks before the age of eight or after that of sixteen years. Those of a weakly constitution, or whose health has been impaired by confinement or improper nourishment, are chiefly subject to it. The great cause of it is a disordered state of the digestive organs, producing a certain degree of mental weakness. This disease usually disappears under judicious treatment, or as the patient grows up; but occasionally it terminates in epilepsy, paralysis, or idiocy. The proper mode of treatment is to restore the tone of the system by tonics, a nourishing diet, and frequent exercise in the open air.

CHOUGH, *tshuff* (Sax., *ceogh*) (*Fregilus graculus*), an European bird, much resembling in size and habits the jackdaw; its colour, however, is in parts different. It is of a jet black over its upper parts, while the head and neck feathers are tinted with purple. The beak is bright vermilion, bent from the base, and very strong. The legs and feet are of the same colour as the beak, and powerfully formed. Its length, when full grown, is about fifteen inches. It is most common in mountainous districts, and builds its nests on lofty cliffs, or ruined towers. It lives in societies like the rooks. Like the jackdaw, the chough is easily tamed, and just as mischievous and entertaining when its domestication has been accomplished.

CHROMATES, *kro'-maits* (from *chromium*), salts formed by the union of chromic acid with certain bases. (*See* BASE.) There are three kinds—basic, neutral, and acid, most of which are highly coloured. (*See* CHROMIC ACID.)

CHROMATICS, *kro-mat'-iks* (Gr., *chroma*, colour; terminal, *ikos*), that part of the science of optics which explains the properties appertaining to colours. (*See* COLOUR, LIGHT, OPTICS, SPECTRUM.)

CHROMIC ACID, *kro'-mik*, Cr_2O_3.—This acid occurs in nature in combination with lead as chrome yellow, and with iron as chrome ironore. It is prepared by adding one measure of a warm saturated solution of bichromate of potash to one and a half of concentrated sulphuric acid. The acid is added in small portions at a time, the solution being allowed to cool between each addition. Chromic acid crystallizes out, and bisulphate of potash remains in solution. The most useful of the compounds of chromic acid is the bichromate of potash. Both the chromate and the bichromate are extensively used in dyeing and calico-printing. Bichromate of potash is employed in conjunction with sulphuric acid in the laboratory as an oxidizing agent, and in commerce in the same manner in bleaching sperm oil. The bichromate of ammonia is used in photography. Except the chromate of lead, or chrome yellow, the other chromates and bichromates are unimportant.

CHROMIUM, *kro'-mi-um* (Gr., *chroma*, colour)—symbol Cr, atomic weight 26·21, specific gravity 5·9—a rare metallic element discovered by Vanquelin, in 1797. Its most important ore is the chrome iron-stone, a compound of protoxide of iron and sesquioxide of chromium. It is also found as chromate of lead, from which mineral Vanquelin obtained it. Its compounds are remarkable for their numerous and brilliant colours, whence its name. To effect its reduction, oxide of chromium is intimately mixed with powdered charcoal, and made into a paste with oil. It is then introduced into a crucible lined with charcoal, and carefully luted down. The whole is exposed to the action of a powerful wind-furnace for several hours, and an impure mixture of carbon and chromium is formed in the crucible. Chromium is a light-grey metal, very brittle, non-volatile, and non-magnetic. As might be inferred from the difficulty with which it is reduced, chromium, in the metallic state, has not yet received any useful application. Its oxide and many of the chromates have received useful applications in calico-printing and china-painting. The manufacture of bichromate of potash is very important, not less than 1,500 tons of chrome iron-stone being annually imported from the United States and Norway, to be converted into this useful salt.

Chlorides of Chromium.—There are two principal chlorides of chromium,—the *protochloride* and the *sesquichloride.* The former is formed by passing a dry current of hydrogen over the sesquichloride heated to redness; hydrochloric acid is given off; and the protochloride remains in the form of a white powder, soluble in water, with which it forms a bluish-green solution that rapidly absorbs oxygen from the air.—*Sesquichloride of chromium* is formed in beautiful transparent plates of the colour of peach-blossoms by passing a current of dry chlorine over a mixture of sesquioxide of chromium mixed with charcoal contained in a porcelain tube heated to redness. Being volatile, the sesquichloride condenses at the cool end of the tube in the beautiful form just described. Thus prepared, it is quite insoluble in water and acids. Solution of sesquichloride of chromium is prepared from the hydrated sesquioxide by dissolving it in hydrochloric acid. The solution, on evaporation, yields green crystals, containing two equivalents of hydrochloric acid and ten equivalents of water. It is a singular fact, that only two-thirds of the chlorine contained in the solution of this salt is precipitated by nitrate of silver. A violet chloride may be formed by precipitation from the violet sulphate by chloride of barium, from the solution of which the whole of the chlorine can be precipitated by nitrate of silver.

Chromium, Oxides of.—Chromium forms several compounds with oxygen, of which the most important are four:—Protoxide, sesquioxide, chromic acid, perchromic acid.—*Protoxide of chromium* can only be obtained in the state of hydrate on adding caustic potash to a solution of the protochloride. It absorbs oxygen with great avidity, decomposing water and setting free the hydrogen, becoming converted into a hydrated intermediate oxide. The protoxide of chromium forms a double sulphate with sulphate of potash, closely corresponding to the double sulphate of iron and potash, in form and composition. The crystals are of a fine purple colour.—*Sesquioxide of chromium* is obtained as a greyish green hydrate, by boiling with alcohol a solution of bichromate of potash acidulated with sulphuric acid. The anhydrous green oxide is not decomposed by heat; hence it is of great use in china and enamel-painting. It is generally prepared for this purpose by exposing chromate of mercury to a red heat. The difficulty with which this oxide is decomposed by ordinary chemical re-agents has rendered it useful as a pigment for printing bankers' cheques and other important documents. Oxide of chromium is the colouring matter of the emerald, pyrope, greenstone, and other minerals.—*Chromic acid* has already been considered under that head.—*Perchromic acid* is formed by adding an aqueous solution of peroxide of hydrogen to chromic acid.

CHROMOSPHERE, *kro'-mo-sfere,* the name given by Mr. Lockyer to the layer of red matter which surrounds the sun. The existence of this solar envelope was first pointed out by Secchi, and recent investigations have fully established the truth of Secchi's statement. (*See* SUN.)

CHRYSALIS. (*See* INSECT TRANSFORMATIONS.)

CHRYSANTHEMUM. (*See* CORYMBIFERÆ.)

CHRYSIS, *kris'-is,* a family of hymenopterous insects (*Chrysidæ*) forming a connecting link between the *Ichneumonidæ,* and bees, wasps, &c. In this country they are popularly known as golden-tailed and ruby-tailed flies. They may be seen poised in the air, in the sunshine, and so rapid is the motion of their wings, that only the body of the insect is visible.

CHRYSOBERYL, *kris'-o-be-ril,* a beautiful gem, of a yellowish-green colour, almost transparent, and having a double refraction. It is found in six-sided crystals, in granite and alluvial soils in some parts of Southern Asia, America, and Siberia. It is very hard, and exhibits an opalescent play of light.

CHRYSOCOLLA, *kris-o-kol'-la* (Gr., gold glue), an ore of copper, sometimes known as copper green, found in Cornwall, and very abundantly in North America. It was formerly much used as a pigment.

CHRYSOLITE, *kris'-o-lite* (Gr., golden stone), a mineral of a fine green colour, and a vitreous lustre, composed of silica, magnesia, and oxide of iron, transparent, and having a double refraction. Jewellers use it as an ornamental stone. It is found in Egypt and some parts of Eastern Asia, and also in Brazil. In the New Testament, the chrysolite is mentioned as one of the precious stones of the New Jerusalem; but the stone referred to was probably a species of topaz.

CHRYSOPRASE, *kris'-o-prase,* a very valuable variety of chalcedony of an apple-green colour, found in Lower Silesia, and in the state of Vermont, United States. It is used for rings, necklaces, brooches, and other articles of jewellery. One of the precious stones forming the foundation of the New Jerusalem is named in the book of Revelation, chrysoprasus.

CHRYSOBALANEÆ, *kri-so-bai-lai'-ne-e* (Gr., *chrusos,* gold; *balanos,* a nut), a sub-order of the natural order *Rosaceæ.* The plants belonging to this division are trees or shrubs, principally natives of the tropical parts of America and Africa. Many of them produce edible fruits. The typical genus *Chrysobalanus* includes two valuable fruit-trees. *C. Icaco* yields the cocoa-plum of the West Indies; and in Brazil the roots, bark, and leaves are prescribed against diarrhœa and other similar maladies. *C. luteus* yields a fruit which is eaten in Sierra Leone.

CHRYSOPHYLLUM, *kri-so-fil'-lum* (Gr., *chrusos,* gold; *phullon,* a leaf), a genus of tropical trees belonging to the natural order *Sapotaceæ.* The species *C. Cainito* yields a delicious fruit known as the star-apple. *C. Buranheim* furnishes astringent bark called Monesia bark, which has been much employed in France and Germany. This bark contains an acrid principle called *monesine,* which is analogous to *saponine.*

CHUB, *tshub* (Ang.-Sax.) (*Leuciscus cephalus*), a freshwater fish of the same genus as the roach, dace, bleak, &c. It is plentiful in many of the rivers of England and of the south-west of Scotland. The chub spawns in May, and comes into condition again about the end of June or beginning of July. It bites freest, and is in the best condition for bottom-fishing, between the middle of October and November. The colours of the chub are blue-black on the upper part, silvery white below; cheeks and gill-covers golden yellow. Weight seldom exceeding five pounds. Is not considered a great dainty.

CHURCHYARD BEETLE. (*See* BLAPS.)

CHYLE, *kile* (Gr., *chulos,* juice), is the milk-like fluid which is formed by the action of the bile and pancreatic juice upon the chyme in the duodenum, and absorbed by the lacteal vessels. The use of the chyle is to supply the matter from which the blood is formed and the waste of the living organs repaired. *Chyme* is the ingested mass formed by the action of the stomach upon the food, and which passes from the stomach into the duodenum. (*See* DIGESTION.)

CIBOTIUM, *si-bo'-te-um,* a genus of ferns, natural order *Filices,* including several species which produce silky hairs useful to man. The styptic called *penawar,* which is often used in

Holland and Germany, consists of the fine hairs from the caudex of *C. Barometz*, the "Scythian lamb" of old writers. These hairs are imported from Sumatra, and are sometimes employed for stuffing cushions. Similar hairs are brought from the Sandwich Islands, and are known under the name of *pulu*.

CICADA, *se-kai'-da* (Lat., grasshopper), a genus of insects of the order *Hemiptera*, common in tropical and warm temperate regions, and remarkable for the loudness of the sounds they emit. The organs that produce these shrill sounds consist of membranes and fibres connected with powerful muscles, and situated on the underside of the abdomen. The largest insect of this genus does not exceed an inch in length; yet it is asserted that it may be heard in the still night at a distance of at least half a mile, and that the sound emitted is like grinding a knife on a whetstone. Notwithstanding the name given to the insect, it has no resemblance to the grasshopper, and no power of leaping. The Italian name is *cicale*; the French, *cigale*.

CICATRIZATION, *sik'-a-tri-zai'-shun* (Lat., *cicatrico*, I heal up), is a term applied to the healing or skinning over of an ulcer or broken surface of the skin.

CICELY, *sise'-le*, a genus of umbelliferous plants (*Myrrhis*), nearly allied to chervil. It is most common in the southern parts of Europe and Asia. In this country it is commonly known as sweet chervil, and in Scotland as myrrh. In Germany soup is made of the seeds, roots, and young leaves.

CICER, *si'-ser* (from Gr., *kikus*, strength, in reference to its qualities), a genus of plants belonging to the natural order *Leguminosæ*, sub-order *Papilionaceæ*. *C. arietinum*, a native of the countries around the Mediterranean, produces the edible seeds called chick-peas. These are the most common parched pulse of the East.

CICHORIUM, *si-kor'-e-um* (Lat.), a genus of plants belonging to the natural order *Compositæ*. The species *C. Intybus* is the wild chicory or succory, a plant indigenous to this and many other countries of Europe, having numerous heads of bright-blue handsome flowers. It is extensively cultivated for the sake of its roots, which are sliced, roasted, and ground, to form the chicory of the shops, which is sold as a substitute for, or more frequently as an addition to, ground coffee.

CICINDELIDÆ. (*See* TIGER-BEETLES.)

CICUTA, *si-ku'-ta*. (*See* HEMLOCK.)

CIDARIS, *si'-dar-is*, a genus of *Echinidæ*, or sea-urchins, only one species of which, *C. papillator*, is found in the British seas, and that only on the coast of Zetland. The markings of the shell and spines are very beautiful.

CILIUM, *sil'-i-um* (Latin), a name given to the eyelid or eyelash; and hence the term *ciliary* is applied to the arteries, glands, &c., belonging to the eyelids.

CILIARY BODY, OR PROCESS.—The muscular fibres which control the crystalline lens of the eye. (*See* EYE.)

CIMOLITE, *si'-mo-lite*. (*See* FULLER'S EARTH.)

CINCHONA, *sin-ko'-na*, the typical genus of the natural order *Cinchonaceæ*. The plants of this genus are natives of the intertropical valleys of the Andes, and are found principally on the eastern face of the Cordilleras, growing commonly at heights varying from about 4,000 to nearly 12,000 feet above the level of the sea. The cinchona region extends from Santa Cruz de la Sierra, in Bolivia, about 19° S. lat., through Peru and Columbia, nearly to Caracas, in about 10° of N. lat. The plants are small shrubs or large forest-trees, with evergreen leaves and commonly showy flowers. They appear to require great moisture, and a mean temperature of about 62°. The cultivation of these plants has lately been commenced in India with some success, and so highly are the medicinal qualities valued, and so greatly is a "quinine famine" dreaded, that energetic steps have been taken in other parts of the world to cultivate them. The barks of several species and varieties are extensively used in medicine, and are undoubtedly the most valuable drugs known. They are imported into this country under the names of *Cinchona*, *Peruvian* and *Jesuits' Bark*. Twenty-six different varieties have been described by Pereira; and Weddell has enumerated no less than thirty-nine. The most important are *Loxa*, or crown bark; grey, silver, or *Huanuco* bark; *Calisaya*, or yellow bark; and red bark. These four are officinal in our pharmacopœias, and are the sources of the precious alkaloids *quina* or *quinine*, *cinchonia*, and *quinidia*, which are all used in medicine, and possess in an eminent degree tonic, febrifugal, and antiperiodic properties. The barks themselves have similar properties, and are, moreover, slightly astringent. The name cinchona was given to the genus by Linnæus, in compliment to the countess of Cinchon, whose husband was the viceroy of Peru. She had derived great benefit from the bark during her residence in South America; and on her return to Europe, in 1639, she brought with her several specimens. The medicinal use of the bark was first made known in Europe by the Jesuits.

CINCHONACEÆ, *sin-ko-nai'-se-e*, a natural order of dicotyledonous plants in the sub-class *Corollifloræ*, including 2,500 species, which are grouped into 318 genera. They are almost exclusively natives of tropical and warm regions. They yield many valuable medicinal agents, the most important being quinine (*see* CINCHONA) and ipecacuanha (*see* CEPHAELIS). They also furnish many substances useful in the arts and domestic economy; such as dye-stuffs, tanning agents, edible fruits and seeds, and ornamental woods. The coffee-plant belongs to this extensive order. (*See* COFFEA.) Most of the plants have beautiful and fragrant flowers, and some, such as the genipa of South America, and the native peach of Sierra Leone, produce fruit of agreeable flavour.

CINERARIA, *sin-e-ra'-ri-a*, a genus of herbaceous plants, of the natural order *Compositæ*, nearly allied to groundsel, and found in nearly all parts of the world. The flowers of some of the species are very pretty.

CINNABAR, *sin'-na-bar* (Gr., *kinnabari*), known also as *sulphide of mercury*, the principal ore of mercury, from which the greater proportion of all the mercury of commerce is obtained. It contains 86·2 parts of mercury and 13·8 parts of sulphur. Native cinnabar is found in masses, crystallized in six-sided prisms, rhombs, and octohedra. It is of various colours, sometimes appearing steel-grey, and at others bright red. It is not found in Britain, but occurs in France, Hungary, and Spain, in Siberia and Japan, and in large quantities in South America. It has also been imported from China. Under the name of *vermilion*, cinnabar is used as a pigment, when refined. Hepatic cinnabar is a variety containing a little carbon, and so called on account of its liver-brown colour, from the Greek word *hepar*, the liver.

CINNAMOMUM, *sin-na-mo'-mum* (Lat.), a genus of plants belonging to the natural order *Lauraceæ*, including many species remarkable for their aromatic properties. *C. Zeylanicum*, the cinnamon-tree, a native of Ceylon, is extensively cultivated in that island, also on the Malabar coast, in Java and Cayenne, for the sake of the aromatic bark of the young branches, which forms the *true cinnamon* of commerce. Cinnamon is much employed as a spice, and medicinally as a cordial, stimulant, carminative, astringent, antispasmodic agent, and as an adjunct to other medicines. It owes its properties to the presence of a volatile oil and tannin. The volatile oil is imported from Ceylon, where it is obtained from the rejected bark by distillation. It is known by the name of *oil of cinnamon*, and is used medicinally as a stimulant, and by cooks and confectioners for flavouring. From the leaves of the tree another volatile oil, similar to oil of cloves in odour and taste, is prepared. From the ripe fruits a concrete fatty substance called *cinnamon suet* is obtained by expression. The cinnamon-tree is the kinnemon or kinman of the Bible.

CINNAMON. (*See* CINNAMOMUM.)

CINNAMON-STONE, *sin'-na-mon*, a variety of garnet, also called *essonite*, of a light cinnamon-yellow colour and high lustre. If carefully cut and skilfully polished it commands a good price. It is a silicate of alumina and lime.

CINNYRIS, *sin'-ne-ris*. (*See* SUNBIRD.)

CINQUEFOIL, *sink'-foil* (Fr., five-leaved.) (*See* POTENTILLA.)

CIRCINUS, *sir-sin'-us*, a constellation of the southern sky, also known as the Compasses.

CIRCÆA, *ser-se'-a*, a genus of small herbaceous plants of the natural order *Onagraceæ*. One species, *C. Lutetiana* is found in shady situations in most parts of Europe. In England it is commonly known as the enchanter's nightshade, and Germans call it the witches' herb. It is not known why these names were given; but the botanical name is of similar import, being taken from Circe, the fabulous enchantress of ancient Greece, mentioned by Homer. Other species of the genus are found in the Himalaya.

CIRCLE, *ser'-kle* (Fr., *cercle*; Lat., *circulus*), is, according to Locke's definition, "a line continued till it ends where it began, having all its parts equi-distant from a common centre." The boundary line is called the circumference or periphery. Any straight line drawn through the centre and terminating in the circumference is called a diameter. The proportion of the circumference to the diameter is very nearly 3·14159; but cannot be exactly expressed with any number of decimals. Many attempts have been made to ascertain the quadrature of the circle; that is to find a square, the contents of which are exactly equal to the area of a given circle; but as the diameter and the circumference are in fact incommensurate, the problem is insoluble. The circle is one of the elements of plane geometry, the right line being the other; and those constructions only are regarded as geometrical which can be made by the aid of these two elements. The circle, however, derives its chief importance from its application in trigonometry to the measurement of angles. This application is dependent on the fact that if circles of the same radii be described from the vertices of angles as centres, the arcs of the circles intercepted between the sides are always proportional to the angles. It is for this reason that the circle is almost always employed to compare angles with each other. For this purpose the circumference of the circle is divided into four equal parts, each of which is called a quadrant; each quadrant is divided into ninety equal parts, called degrees; each degree is divided into sixty equal parts, called minutes; each minute into sixty equal parts, called seconds.

In Logic, the term "reasoning in a circle" is applied to a kind of false reasoning, in which the principle is supposed which it is intended to prove, and afterwards the principle is proved by the thing which it seemed to have proved. The same fault takes place in definitions, when an idea is defined by others which suppose the knowledge of the first.

Circle of the Celestial Sphere.—Any circle, the plane of which passes through the celestial sphere, as the ecliptics. (*See* ECLIPTIC.)

Mural Circle, an instrument used by astronomers for determining the meridian altitude or zenith distance of a star. It consists of an astronomical telescope firmly fixed to a graduated circle, which moves about a horizontal axis, the eye-piece and object glass of the telescope being crossed by five lines (generally of spider web) one horizontal and five vertical. When the instrument is properly adjusted, the line joining the optical centre of the object-glass with the intersection of the horizontal and middle vertical wire moves in the plane of the meridian and by very careful observations, the position of the star is ascertained.

CIRCUIT GALVANIC. (*See* ELECTRICITY.)

CIRCULAR NUMBERS are numbers the powers of which end on the same figures as they do themselves, as in the case of numbers ending in 0, 1, 5, 6.

CIRCULATION OF THE BLOOD, *sir-ku-lai'-shun* (Lat., *circulus*, a circle), is applied to the course of the blood through the body, from the heart to the capillaries, and from the capillaries back again to the heart. The several organs of circulation are the heart, arteries, veins, and capillaries. By the heart the blood is propelled through the arteries to all parts of the body. The capillaries are very minute vessels, connecting the extremities of the arteries with those of the veins, and by the veins the blood is returned again to the heart. (*See* HEART.) The pulse which is felt in the arteries is caused by the action of the heart propelling the blood in waves through the body. The discovery of the circulation of the blood is due to Dr. Harvey, afterwards physician to Charles I.; the opinion previous to his time being, that the blood circulated only in the veins, and that the arteries, from being always found empty after death, contained nothing but air; and hence their name.

Circulation of Sap, the ascent of the sap from the root to the leaves and bark of plants, and its partial descent after the elaboration which it undergoes in these organs.

CIRCUMPOLAR STARS (*circum*, around,

and *Polus*, the pole), stars which move round the pole of the heavens without setting. Their distance from the pole, thus, does not exceed the latitude of the plane of observation.

CIRRHOPODA, OR CIRRIPEDA, *sir-rop'-o-da* (Lat., curl-footed), animals of the class *Articulata*, of which barnacles and balani are familiar examples; all in their native state permanently attached to rocks, sea-weed, shells, and some are found imbedded in the skin of whales and the flesh of sharks. They are distributed over the whole world. Nearly all the species are hermaphrodite. The young possess the power of locomotion, and are furnished with eyes, which disappear after they have permanently fixed themselves to some of the objects mentioned; and they have also shells quite different from those of their native state.

CIRRHUS, OR CIRRUS, *sir-rus* (Lat., a curl of hair), a tendril or leaf assuming the form of a slender spiral, by which the plant clings to other objects, and is so enabled to climb. The vine, pea, and many other familiar plants afford examples.

CIRRUS. (*See* CLOUDS.)

CISSAMPELOS, *sis-sam'-pel-os* (Gr., *kissos*, ivy; *ampelos*, a vine), a genus of plants belonging to the natural order *Menispermaceæ*. The root of *C. Pareira*, a climbing plant indigenous in Brazil, is an article of our Materia Medica, and is commonly known as *Pareira brava*. It possesses bitter, tonic, and diuretic properties, which are chiefly due to the presence of an uncrystallizable alkaloid named *cissampeline* or *pelosine*.

CISTACEÆ, *sis-tai'-se-e* (Gr., *kiste*, a box or capsule), the Rock-rose family, a natural order of dicotyledonous plants in the sub-class *Thalamifloræ*, consisting of seven genera and 185 species, chiefly natives of the south of Europe and north of Africa; they are shrubs or herbs. The *Cistaceæ* have resinous and balsamic properties. From species of the typical genus *Cistus*, or rock-rose, a fragrant resinous substance, called *Ladanum*, is obtained in the Levant. This is used medicinally as an expectorant and emmenagogue, and is much esteemed by the Turks as a perfume. A gum called *Kuteera*, which is sometimes substituted in India for tragacanth, is the produce of a plant of this order, named *Cochlospermum Gossypium*.

CITRON, *sit'-ron*, *Citrus medica*. (*See* CITRUS.)

CITROSMA, *si-tros'-ma*, a genus of trees, natives of the tropical parts of South America, belonging to the natural order *Monimiaceæ*. An oil resembling the oil of citron is obtained from the leaves.

CITRUS, *si'-trus* (said to be from the town *Citron*, in Judea), a genus of plants belonging to the natural order *Aurantiaceæ*. The different species and varieties of this genus yield the fruits known under the names of orange, lemon, lime, shaddock, pompelmoose, forbidden fruit, kumquat, and citron. (*See* various headings.) *C. medica* yields the fruit called the citron, which is supposed to be the Hebrew *tappuach*, translated in the English version of the Old Testament as "apple." The rind of the citron is imported in a preserved state, and is used in confectionery. The pulp is less acid and juicy than that of the lemon. Besides the fruits already mentioned as obtained from the genus *Citrus*, we have the shaddock, from the species *C. decumana*; the forbidden fruit, from *C. Paradisi*; the pompelmoose, from *C. Pampelmos*; and the kumquat of China, from *C. japonica*.

CIVET (*Viverra*), *siv'-et*, a carnivorous quadruped, native of North Africa. Its size is about two feet six inches in length, and ten or twelve inches in height; head long; muzzle sharp, as in the weasel: a narrow bristly mane runs from the pole of the neck to the tail. Its colour is brownish grey with black bands and spots. It is a carnivorous animal, and preys on birds, small quadrupeds, and reptiles. The true civet's most remarkable feature consists of a sort of pouch between the anus and sexual organs, in which collects an odorous liquid of considerable value in the perfume-market. For the sake of this the animal is very commonly kept in confinement.

CLADIUM, *kla'-di-um*, (Gr., *clados*, a twig), a genus of plants of the natural order *Cyperaceæ*. One species only, the *C. Mariscus* is found in Britain. It attains a height of nearly 5 feet and grows freely in the fern districts where it is used for fuel and for thatching.

CLADONIA, *kla-do'-ne-a*, in Botany, a genus of lichens. *C. rangiferina* is the reindeer moss, so termed from constituting the principal food of the reindeer. *C. pyxidata* is commonly termed cup-moss; it has been employed as a remedy in hooping-cough.

CLAM, *klam*. (*See* CHAMA.)

CLAM, BEARS' PAW, a favourite shell for the cabinet, found in the South Seas and belonging to a bivalve mollusc (*hippopus maculatus*) of the family *Tridacnidæ*. It is most beautiful in form, texture, and colour, and is regarded as the best of the bivalves.

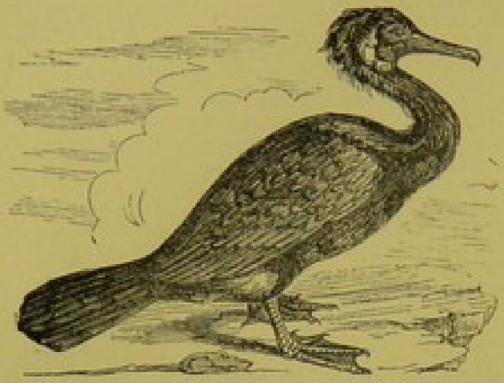
CLARY, *kla'-ry* (*Salvia sclarea*), a plant resembling the sage, and of the same genus. It is a native of the southern countries of Europe, and has been cultivated in English gardens for its aromatic properties. It is sometimes used for seasoning soups, and a fermented wine is sometimes made from its flowers. A species, the wild Clary (*Salvia Verbenaca*), is found in Britain.

CLASS, *klas* (Lat., *classis*), a group of orders in Botany possessing some important structural characters in common. (*See* BOTANY.) The word, as signifying a separate group or rank, has almost innumerable applications, scientifically and socially.

CLAVAGELLA, OR CLUB SHELL, a genus of lamellibranchiate molluscs, inhabiting holes in rocks or masses of coral, which they excavate for themselves. They belong to the same family as the Aspergillum (*q.v.*)

CLAVICLE, OR COLLAR-BONE, *klav'-e-kl* (Lat., *clavicula*, from *clavis*, a key), the bone which extends horizontally from the sternum to the scapula, and serves to keep the shoulders apart, that the arm may enjoy a freer and wider range of motion. It takes its name from its resemblance to the ancient Roman key, and it is curved somewhat in the form of an italic *f*.

CLAVICORNES, *kla-vi'-kor-nez* (Latin, club-horned), a large family of the *coleoptera*, remarkable for the club-shaped termination of their antennæ. There are many genera, nearly all of which feed upon animal substances. The burying



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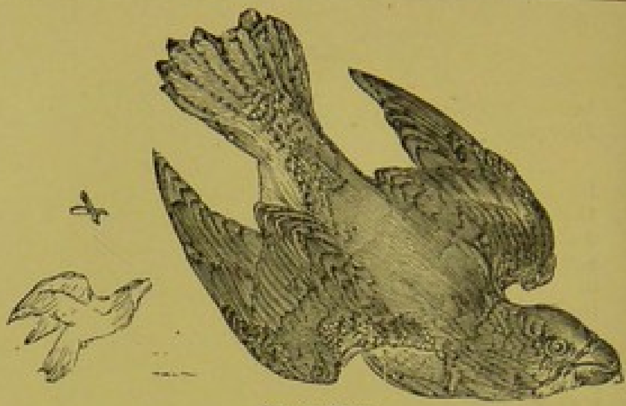

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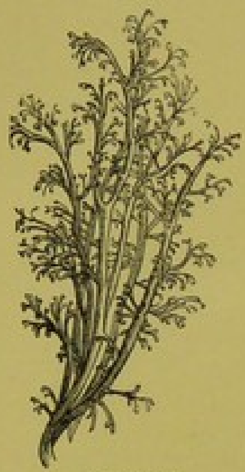

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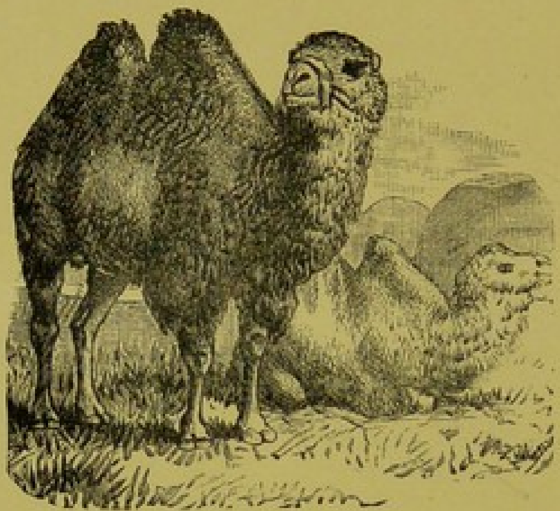

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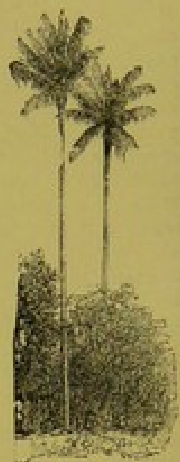

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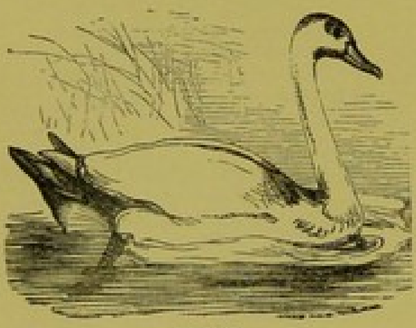
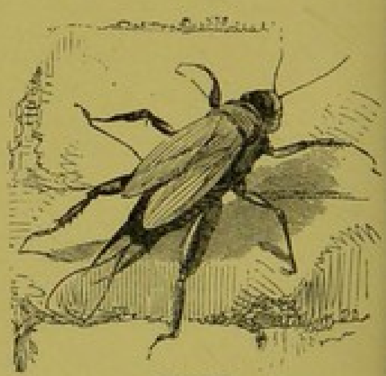


CYGNET.

CAPITULUM.



CRICKET.

CORK TREE.

CRAY FISH.

CLOVE.

beetle affords a good example. (*See* BURYING BEETLE.)

CLAY, *klai* (Sax., *clæg*).—The common name for any earth which is plastic and tenacious, all this kind of earth appears to be formed from the disintegration of felspathic rocks by the combined action of the air and water. It necessarily varies in its composition, but its fundamental constituent is alumina, sometimes to the extent of 40 per cent. of the whole mass. Ordinary clay contains, in addition, small portions of undecomposed rock, potash, oxide of iron, lime, and magnesia, the character of the clay being much modified by the preponderance of one or other of the ingredients. One of the great characteristics of clay in its hydrated condition is its plasticity, and its capability of being made hard by heat—properties which render the different kinds of this substance available for various fictile purposes. The purest kind of clay is *kaolin* or *china-clay*, which is formed by the disintegration of felspathic rocks. (*See* PORCELAIN MANUFACTURE.) *Pipe-clay* is a white clay nearly free from iron, and found in large quantities in the island of Purbeck. Common *potter's clay* contains a considerable amount of iron. The blue clay of Devonshire and Dorsetshire is much valued, being very plastic, and yielding a very white paste when burnt. The coarser varieties, which contain a large proportion of sand, are used for making brown stone-ware. *Brick-clay* contains varying proportions of iron; hence different counties build houses of different colours. The clay of the midland counties contains large quantities of iron, and the bricks made from it are of a bright red hue, while London bricks are yellow or brown, from deficiency of colouring material. When the proportion of iron is very much increased, we get the different coloured ochres. *Marl* is clay containing a notable proportion of carbonate of lime. *Fuller's-earth* is a clay of a peculiar kind, which, when dried, possesses the property of absorbing grease from woollen fabrics, and is employed for that purpose. It contains a small percentage of magnesia.

CLAY SOILS. (*See* SOILS.)

CLAY IRON-STONE. (*See* IRON ORES.)

CLEAVAGE, *kleev'-aj* (Sax., *cleofan*, to split), a term applied to the property possessed by crystals of separating into natural layers. (*See* CRYSTALLOGRAPHY.) In Geology, the term implies a condition of rocks in which they split easily into thin plates. Though generally confined to clay slate, cleavage occurs in lime and sandstone.

CLEAVERS. (*See* GALIUM.)

CLEG, *kleg*, a troublesome insect of the dipterous family *Tabanidæ*, very annoying to horses, cattle, and even human beings in hot weather, piercing their skins with the sharp lancet with which the mouth is furnished and sucking blood. It is about one-third of an inch long, black in colour, and with yellow markings on the stomach.

CLEMATIS. (*See* CLEMATIDEÆ.)

CLEMATIDEÆ, *klem-a-ti'-de-e* (Gr., *klema*, a tendril), a tribe of plants in the natural order *Ranunculaceæ*. The typical genus of the tribe is *Clematis*, which includes several beautiful climbers commonly cultivated in our gardens; also one indigenous species, *C. vitalba*, usually called "traveller's joy."

CLERUS, *kle'-rus*, a beautiful beetle, found on flowers, belonging to the order *Coleoptera*, section *Pentamera*. It is about half-an-inch long, of greenish hue, with scarlet wing-cases. Its larvæ feed upon the larvæ of bees, but how this can be done in a bee-hive with impunity is still one of the secrets of nature.

CLEVELAND IRONSTONE. (*See* IRON.)

CLICK BEETLE, OR SKIP-JACK, the common name for many species of coleopterous insects of the tribe *Elaterides*, the larvæ of which are well known to farmers by the name of wire-worm. When laid on their backs, they regain their feet by a sudden spring, and give forth a "clicking" sound—hence their names. They are dull in colour and small in size; the largest is only half-an-inch long.

CLIMATE, *kli'-mat* (Gr., *klima*, a slope), also signifying certain zones on the earth's surface from their supposed inclination to the pole. Formerly, the ancient geographers divided the earth into zones or slopes (called *climates*), according to their descent from the equator to the poles, and having different temperatures in the various slopes or regions. The old "climates," therefore, served the same purpose as our parallels of latitude. In its present and most general acceptation, the word *climate* may be said to signify all those atmospheric conditions, such as heat, moisture, winds, &c., pertaining to any country or district. The principal elements that go to constitute climate are heat and moisture, the latter being dependent upon the former. The sun being the great source of heat, it follows that, as a general rule, the temperature of a place would depend upon its latitude, or distance from the equator, and that all places in the same latitude would enjoy the same kind of climate. Were the surface of the earth composed of a homogeneous fluid mass, or of strata of rock perfectly alike in colour, density, and smoothness, this would actually be the case; for all places in the same latitude would receive the solar rays at the same angle, and having the same capacity for absorbing and radiating heat, would possess exactly the same climate. This, however, is not the case. Geographers now therefore divide the earth into three zones or belts of climate—the Arctic or Frigid, the Temperate, and the Torrid (*see* ZONE), according to the distance of these surfaces from the equator, and the consequent cold, warmth, or heat which is the distinguishing feature of the zone. The other causes which modify climate are—1. Elevation above the sea-level, the air becoming gradually colder as we ascend; so that even in the torrid zone the summits of very high mountains are covered with perpetual snow. 2. The slope of a country. The power of the sun's rays in imparting heat to the earth depending upon the angle at which they strike the surface, it follows that this must have been an important influence upon its climate. Hence in the Alps of the Valais, for instance, on the one side may be seen the vine in luxuriant growth, whilst the other is thick-ribbed with ice. 3. The ocean is a very important element in determining the nature of a climate. Islands and districts near the sea uniformly enjoy a milder and more uniform climate than inland regions in the same latitude. In summer the sea is not so much heated by the sun's rays as the land; and hence cooling sea-breezes temper the warmth of that season, while in winter the cold is mitigated in consequence of the water retaining its heat longer than the land. Thus Dublin, though 4° farther north than Heidelberg, has nearly the same mean annual temperature; whilst its winters are almost 6° warmer and its summers nearly 5° cooler. 4. Mountains affect climate in various ways, by influencing the direction of currents, and by attracting and condensing the vapours in the atmosphere. 5. The nature of the soil and the state of cultivation operate materially upon climate. Different kinds of soil have different powers of radiating and absorbing heat; and a region shrouded in forests, or covered with swamps and marshes, will have a different temperature when cleared and drained. Marshes, by evaporation, deprive the surface of much of its heat; and forests, by intercepting the sun's rays, and by the increased exhalant surfaces exposed to the air, undoubtedly affect the temperature. Hence in hot climates forests tend to cool the air, and in frigid regions to prevent the loss of the earth's heat by chilling blasts. 6. The prevalence of particular winds also influences the character of a climate; as also does 7, the proximity of an oceanic current bringing water of a higher or a lower temperature than that of the surrounding sea. It will thus be seen that there are numerous circumstances that tend to modify the climate of any particular place, and that mere lines of latitude afford but an imperfect indication of the temperature. Hence geographers have had recourse to other lines, called *isothermal*, which are carried through all places having the same mean annual temperature. (*See* ISOTHERMAL LINES.) These lines diverge more and more from the parallels of latitude as they recede from the equator. In the American continent they descend much lower than in Europe; and in the southern hemisphere the mean annual temperature is much lower than in the northern, on account of its having much less land. But places having the same mean annual temperature may yet have very different climates; for places having a moderate summer and winter may yet have the same mean annual temperature as others where the summer and winter are extreme. In addition to heat, another great constituent of climate is moisture, which takes the forms of Rain, Vapour, Fog, and Dew (*see* various headings). In the torrid zone there are but two seasons, the wet and the dry. In India, the rainy and dry seasons are not regulated by the position of the sun, but by the change of the monsoons. In some districts there are two rainy and two dry seasons; and in others rain seldom or never falls. Only in the temperate zones can the year be properly said to be divided into four seasons, exhibiting the agreeable vicissitudes of heat and cold—the temperate heats of summer and the healthful rigours of winter in kindly union with the varied charms of spring and autumn. In the frigid zones only two seasons are known—a long and severe winter, followed by a short but fervid summer. This harsh and abrupt transition is occasioned by the great length of the day in summer, when for a time the sun never sets, and by the total absence of that luminary in winter. It is to the varieties in the climate of different places that we are indebted for the great variety that exists in the vegetable and animal kingdoms. Every species of plant has certain climatic boundaries, some much more extended than others, within which alone it will flourish. Animals, too, have their climatic bounds. (*See* ACCLIMATIZE.) To man alone is it given to subsist in any climate, but different climates affect him very differently—some being favourable to health, others tending to disease. The study, therefore, of the effects of different climates upon different constitutions and in different diseases, forms an important branch of medicine. Indeed, there are few diseases that may not be influenced by climate; and hence the necessity to the physician of making himself acquainted with the atmospheric conditions of different localities.

CLIMBERS, the name given to an order of birds (*Scansores*) having toes on their feet both before and behind, so that they can climb trees or similar objects with ease.

CLIMBING PERCH (*Anabas scandens*), *kli'-ming pertsh*.—This singular fish is an inhabitant of the ponds and rivers of most parts of the East Indies. Its general form resembles that of the common English perch; but it seldom attains a greater length than six inches. Its most remarkable characteristic is the structure of the superior pharyngeal bones in which are numerous cells, where a supply of water may be carried for the purpose of moistening the gills when the creature, as its habit is, quits the water for a time. This occurs at times when the pool is in danger of drying up, when the perch travels in search of water. It has been asserted, by explorers whose veracity is beyond question, that this singular fish has been seen *to climb trees* which it does by suspending itself by its spiny gill-covers and fixing its anal fin in cavities of the bark, and urging its way upwards by distending and contracting its body. Its migrations are usually performed at night, or in early morning, whilst the grass is yet wet with dew. Climbing perches are plentiful in the Ganges, and they have been kept in a perfectly lively and healthy condition for five or six days in an earthen pot without water.

CLIMBING PLANTS, plants which have weak stems, and consequently fasten themselves to or twine around other objects in order to raise themselves from the ground. Some, like the well-known Virginia Creeper, attain this object by means of little adhering discs which they put forth; others, like the ivy, shoot out little rootlets from their stems; others again twine their own stems around those objects up which they climb (these are often known by the Latin name *Lianas*), and others put forth *cirri* or tendrils.

CLINKSTONE, OR PHONOLITE, *fo'-no-lite*, a compact greyish green felspathic rock occurring in volcanic districts and remarkable for its liability to laminate, *i.e.*, to split into plates like slates, in consequence of which it is often used for roofing houses.

CLIO, *kli'-o*, a genus of shell-less molluscs, one species of which, *Clio Borealis*, is so extremely abundant in the Arctic seas, that it constitutes a chief part of the food of whales. *Whales' food* is the name by which they are known to the fishermen. Sometimes the water is so full of them that it would be impossible for the whale to open his jaws without engulfing thousands.

CLOACA *klo-a'-ka*, an enlargement of the lower intestine near its termination in birds, reptiles, most fishes, and one order of mammals (the *Monotremata*), answering the purpose of the bladder in other animals.

CLOTHES-MOTH, *kloathz'-moth* (Anglo-

Saxon), a name common to a number of small moths of the genus *Tinea*, whose larvæ are extremely destructive to woollen fabrics, &c. They begin not only to eat as soon as they are hatched, but to hack to bits the substance in which they are hidden, and, uniting the fragments with a glutinous silk of their own production, make cases to live in. Cleanliness and exposure to light are safeguards against these tiresome insects, and spirit of turpentine may be used for killing them.

CLOTHO, *klo'-thō*, a species of spider, *C. quinquemaculata*, about half-an-inch long, found in the south of Europe and north of Africa, and chiefly remarkable for the fact that it spins a tent for itself, shaped like a limpet shell, and about an inch in diameter, in which it deposits its eggs and brings up its young.

CLOUD, *klowd* (Lat., *claudo*, I shut), a condensed mass of watery vapour that floats in the atmosphere or rests on the surface of the earth. In the latter case, the vapour is called fog or mist; and it is only when it rises above us that it is termed a cloud. The height to which clouds rise above the surface of the earth varies with a number of circumstances; such as the temperature of the air, its humidity, the climate and seasons, and the neighbourhood of the sea or mountains. Heavy rain-clouds are frequently about 200 or 300 yards in height; while light fleecy masses of vapour rise to the height of four or five miles. The following is a brief outline of the theory of the formation of clouds. Vapour rising from the moist surface of the earth, or from water warmed by the heat of the sun's rays, is held in suspension in the atmosphere, and remains invisible until the air at some distance above the earth's surface is completely saturated with it; but if the evaporation from below still continues, the atmosphere becomes overcharged with moisture, and the vapour condenses and appears in a visible form. Clouds are primarily defined as *cirrus* (cloud curl), *cumulus* (day or summer cloud), and *stratus* (night cloud). The term cirrus is applied to long streaky white clouds spreading in all directions; they are commonly called mares' tails, and are the forerunners of windy weather; cumulus, to clouds consisting of thick white masses of vapour, ragged and broad at the base, ascending in the form of mountain-peaks; this form of cloud is commonly seen by day. The name stratus is given to a dense horizontal mass of cloud rising above the horizon, and commonly resting on the surface of the land. The mists that rise from valleys, marshes, and water, in the evening, belong to this class of clouds, which are considered as the precursors of fine weather. There are compound modifications of these classes of clouds, composed of the primary modifications variously blended together; they are termed *cirro-cumulus*, *cirro-stratus*, *cumulo-stratus* and *cumulo-cirro-stratus*, or *nimbus*. The nimbus is the dark heavy rain-cloud.

CLOUD BERRY (*Rubus Chamæmorus*), a plant about 10 inches in height having a single stem, free from prickles, few leaves, and a large white flower. It is rarely found in Britain, and then only on high moors. It is more abundant in Sweden and Norway, and the fruit, which somewhat resembles the blackberry or bramble-berry, is highly valued.

CLOVE BARK.—The bark of the tree *Myrtus caryophyllata*, a native of Ceylon and the Marcarene Isles. It is thin and hard, of a deep brown colour, has a taste like cloves, and properties resembling those of cinnamon. CULILAWAN BARK (*q.v.*) is also known as Clove Bark.

CLOVER, *klo'-ver*, a name commonly extended to many plants belonging to the same natural order (*Leguminosæ*), having the leaves formed of three leaflets. The true clover, or trefoil (*Trifolium*), includes a large number of species, chiefly natives of temperate climates, and very abundant in Europe. Many of the species afford important food for cattle. About 17 species are indigenous to Britain. The common red clover (*T. pratense*) is most generally cultivated in this country. The zigzag, or meadow clover, and the white Dutch clover, are also extensively grown. The clovers were not cultivated in Britain till the latter part of the last century; but are now generally grown as alternations with wheat crops. The leaflets of the common clover are almost always marked with a whitish patch in the shape of a horse shoe, and from that cause, perhaps, were in conformity with old superstitious beliefs considered as a charm against witchcraft.

CLOVER-WEEVIL (*Apion*), *weev'-il*, a small coleopterous insect which feeds on the leaves and seeds of clover. The red clover weevil (*A. apricum*) lays its eggs among the flowers, and the grubs eat their way through the calyx into the pod. It is of a bluish-black colour, and about the tenth of an inch long.

CLOVES. (*See* CARYOPHYLLUS.)

CLUB FOOT, *Talipes*, a distortion of the foot, occasioned by the greater contractions of some muscles than others, by which means the foot is drawn out of its natural position, it may be inwards or outwards, with the elevation of the heel and depression of the toes, or the depression of the heel and elevation of the toes and fore part of the foot. Such deformities are usually congenital; but sometimes they may arise from some disordered state of the system, or be occasioned by convulsions. This deformity may now, in almost every case, be cured by a careful subcutaneous division of the contracted tendons.

CLUB-MOSS. (*See* LYCOPODIUM.)

CLUBBING, a diseased growth of tubercular excrescences in the root and stem of cabbages, turnips, and similar vegetables, caused by the larvæ of the cabbage fly.

CLUPEIDÆ, *klu-pe'-e-de* (Lat., *clupea*, a shad), a family of fishes, allied to the *Salmonidæ*, but differing from them because wanting an adipose fin. The herring may be regarded as the type of this family, to which belong also the pilchard, sprat, anchovy, and sardine. They generally congregate in shoals, and periodically visit certain coasts; and are very widely diffused all over the world.

CLUPESOCIDÆ, *klu-pe-sos'-i-de*, a family of malacopterous fishes, which are regarded as intermediate between the *clupeidæ* and the *Esocidæ* (pike, &c.). Some are marine and some fresh water, and they are mostly found in tropical climates, none being British.

CLUSIA, *klu'-se-a* (in honour of Charles de l'Ecluse, a French botanist), a genus of trees belonging to the natural order *Guttiferæ*. The balsam-tree of Jamaica is *C. flava;* and this, with the species *C. alba* and *rosea*, yield a glutinous resinous matter, used in some parts of the West Indies in place of pitch. In Nevis and St. Kitt's the three species are known indiscriminately by the names of fat pork, monkey-apple, and mountain or wild mango. The *C. insignis* is the wax-flower of Demerara.

CLYSTER, *klis'-ter* (Gr., *kluzo*, I wash out), is a name given to certain medicines administered in a liquid form, by means of an injecting syringe, by the rectum, for the purpose of procuring evacuation of the bowels, or otherwise affecting the intestines or the system generally. In cases of lock-jaw, &c., when nutriment cannot be conveyed by the throat, it is sometimes administered in this way.

CLYTUS, *kli'-tus*, a genus of coleopterous insects, abounding in species. A few are found in this country; but North America is their chief abiding-place. There one of the largest of the genus, *Clytus speciosus*, is a great destroyer of the sugar-maple. It is about an inch long, and its colour black, banded and spotted with yellow.

COAL, *kole* (Sax., *col* or *coll*), a mineral consisting chiefly of carbon, and of vegetable origin. Sir Charles Lyell, who paid great attention to the phenomena of the production of coal, thus states his views:—"It appears from the researches of Liebig and other eminent chemists, that when wood and vegetable matter are buried in the earth exposed to moisture, and partially or entirely excluded from the air, they decompose slowly and evolve carbonic acid gas; thus parting with a portion of their original oxygen. By this means they become gradually converted into lignite, or wood coal, which contains a larger portion of hydrogen than wood does. A continuation of decomposition changes this lignite into common or bituminous coal, chiefly by the discharge of carburretted hydrogen, or the gas with which we illuminate our streets and houses." According to Bischoff, the inflammable gasses which are always escaping from mineral coal, and are so often the cause of fatal accidents in mines, always contain carbonic acid, carburetted hydrogen, nitrogen, and olefiant gas. The disengagement of all these rapidly transforms ordinary or bituminous coal into anthracite.

Varieties of Coal.—Mineralogists commonly divide coal into the *non-bituminous* and the *bituminous*. The non-bituminous variety includes anthracite (*see* ANTHRACITE). Anthracites differ much in hardness and readiness of combustion. *Fossil coke* is an American variety, more compact than artificial coke, some kinds containing considerable bitumen; its origin is attributed by Genth to the action of a trap eruption on bituminous coal. *Culm* is a kind of anthracite shale: in parliamentary returns the term is made use of to designate anthracite. Of *bituminous* coal there are several varieties. *Pitch*, or *caking coal*, when heated, breaks into small pieces, which, on the heat being raised, unite in a solid mass: its colour is velvet-black, or greyish black; specific gravity, 1·269: it burns readily with a yellow flame; but requires frequent stirring to prevent its caking, by which the ingress of air for combustion is prevented. Caking coal containing about 87 per cent. of carbon is the most valuable of all coals, and is the most abundant product of the British coal-measures. *Cherry coal* resembles caking coal, but does not soften and cake when heated: it is very frangible; and hence, in mining it, there is considerable waste. Near Birmingham, the loss in mining, including the pillars, amounts to two-thirds of the whole. It burns more rapidly than caking coal, with a clear yellow flame. *Splint* coal is a dry coal, harder than cherry coal: it is a coarse kind of cannel coal. There are other varieties which are still less bituminous; the *flint* coal, which approaches anthracite, being of this kind. The *flew* coal of Wednesbury, in Staffordshire, is of a similar nature; and the *crow* coal of Cumberland, at Alston Moor, is almost without bitumen. (*See* CANNEL COAL, JET, and LIGNITE.)

Coalfields.—Extensive beds of mineral coal occur in Great Britain, in France, in Spain, in Belgium, covering nearly one-twentieth of the whole area;—in the Netherlands, Prussia, Austria, Northern Italy, Spain, Russia on the south, near the Azof. It is found in Asia, abundantly in China, in Persia, in the Cabul territory, and in Khorassan, or Northern Persia; in various parts of India and Upper Assam; in Borneo, Labuan, Sumatra, several of the Philippine islands, Formosa, Japan, New South Wales, and New Zealand. In America, besides the United States, in Chili, at the Straits of Magellan, on Vancouver's Island, as well as in the British provinces of Nova Scotia, New Brunswick, and Newfoundland. In England the principal coal-fields are the Manchester, the Lancashire and Cheshire; the Great Central, of South Yorkshire, Nottingham, and Derby; that of South Wales, Glamorganshire, &c., and the Newcastle field, of Northern England. In Scotland a range of beds extends from the Firth of Forth to the Firth of Clyde. The coal-fields of Great Britain are estimated to occupy an area of 5,400 square miles; and at present about 25,000,000 of tons are consumed annually in this country. In Ireland there are the Limerick fields, about the mouth of the Shannon, the Kilkenny fields to the eastward, and those of Ulster in the north. In the United States there are four extensive coal areas: one of these areas, the Appalachian coal-field, commences on the north in Pennsylvania and South-eastern Ohio, and sweeping south over Western Virginia and Eastern Kentucky, and Tennessee, it continues to Alabama. A second coal area (the Illinois) lies adjoining the Mississippi, and covers the greater part of Illinois, the western portion of Indiana, and a small north-west portion of Kentucky. A third occupies a portion of Missouri and Iowa, west of the Mississippi. A fourth covers the central portion of Michigan. Besides these, there is a smaller coal region in Rhode Island, which crops out across the north end of the island, and appears to the northward as far as Mansfield, Massachusetts. Beyond the borders of the United States on the north-east commences the coal area of Nova Scotia, New Brunswick, and Newfoundland. It has been estimated by the highest authorities that there are probably 146 billions of tons of available coal in the world.

Coal Formation. (*See* CARBONIFEROUS SYSTEM.)

COAL-FISH (*Merlangus carbonarius*), a somewhat common fish, extensively distributed through the principal seas of Europe, being abundant in the Baltic, the Mediterranean, and the Northern seas; also found in large quantities on the coast of Great Britain. It belongs to the same family (*Gadidæ*) as the cod and haddock. It is not unlike the whiting in form, but is much larger, being in many instances nearly three feet in length. It owes its singular appellation to the curious nature of its skin, which, upon being handled, soils the fingers in the same way as would result from touching coal. It is likewise known, during its progress from birth to maturity, by the names of *cuddy*, *sythe*, and *sillock*. The fishermen of Yorkshire, however, have given it two more aliases: when young, they call it *parr*, and the old fish are named *lillets*.

COATI, *ko'-a-ti*, a genus of quadrupeds (*Nasua*) of the family *Ursidæ*, or bear. They are nearly allied to the racoon, and are exclusively American. The snout is elongated and flexible, and is employed in turning up the earth to obtain worms and insects. In South America, the coati, or *coati-mondi*, as it is sometimes named, is often domesticated.

COBALT, *ko'-bawlt* (Germ., *kobold*, from *kobolden*, the name of certain mischievous demons who were supposed to haunt mines, and to manufacture those ores which looked rich to the eye, but were really of little value. Among these were supposed to be the ores of this metal, and hence its name.) Cobalt is a metal very similar to nickel in its physical and chemical properties. It generally occurs in the same ore as nickel, and the separation of the two metals is a task requiring great patience and expertness. Cobalt is obtained as a metal either by reducing the oxide by hydrogen, or by calcining the oxalate. In the metallic state, it closely resembles steel. It fuses with great difficulty, and oxidizes at a high temperature. It remains unaltered in moist air, dissolves slowly in sulphuric and hydrochloric acid, but readily in nitric acid. It is reddish-grey in colour, and is highly magnetic. It is obtained principally from two ores—*Speiss cobalt* and *cobalt glance*.

Compounds of Cobalt.—The compounds of cobalt are remarkable for their beauty of colour. The two colours *zaffre* and *smalt* are compounds of cobalt. Zaffre is an impure oxide of this metal, made by calcining the crushed ore in a reverberatory furnace. The sulphur and arsenic are thus roasted off, and the impure oxide remaining is ground to an impalpable powder with two or three parts of fine sand. Zaffre is used largely in the manufacture of stained glass and in the ornamentation of pottery. *Smalt* is a finely-powdered blue glass coloured with cobalt. Cobalt ore is partially roasted, and combined with an equal quantity of carbonate of potash and twice its weight of well-ground quartz. The whole is melted in suitable pots in a furnace, silicate of potash being formed, in which the oxide of cobalt melts, the other impurities falling to the bottom. The clear blue glass is ladled out, poured into water, and ground, when cool, into an impalpable powder. Smalt is used by paper-makers as a blue pigment for staining paper; and it is also used in the production of the beautiful blue colour in porcelain, glass, encaustic tiles, and other artistic productions. With oxygen, cobalt forms a protoxide and a sesquioxide. The *anhydrous protoxide* is obtained by calcining the hydrate or carbonate. It is a black powder, which, when heated in the air, changes into an intermediate oxide. Oxide of cobalt gives to glass a very intense blue, which resists the action of a very high temperature. Dissolved in ammonia, it gives a fine red liquid. Fused with potash, a brilliant blue compound is obtained. With magnesia, alumina, and oxide of zinc, it produces, when fused at a high temperature, pink, blue, and green compounds. The last two are used as pigments. The hydrated oxide is a pink precipitate thrown down by adding a solution of potash to the solution of a cobalt salt. Protoxide of cobalt forms salts with the acids, which are light blue when hydrated, but turn red when the water is driven off by heat. Protonitrate of cobalt is obtained by dissolving the oxide or the metal in nitric acid. It crystallizes in small deliquescent crystals containing six equivalents of water. A solution of this salt is often employed as a sympathetic ink, being light blue when cold, but bright red when the water of hydration is driven off by a gentle heat. The *sulphate of cobalt* is generally employed as the source of salts of this metal. The *sesquioxide of cobalt* is a brownish powder obtained by passing chlorine through a dilute solution of potash, in which the protoxide is mechanically suspended. Its salts are at present unknown. *Chloride of cobalt* is prepared by dissolving the oxide in hydrochloric acid: the pink resulting yields, on evaporation, rose-coloured octahedra of the hydrated chloride. The other salts of cobalt are uninteresting. A solution of the nitrate is used in blowpipe analysis. *Thénard's blue* is a beautiful pale-blue pigment, consisting of a mixture of phosphate of cobalt and phosphate of alumina.

Cobalt Ores.—The principal ores of cobalt are, *white cobalt ore*, which is the most common (it contains cobalt associated with arsenic, iron, and sulphur); *grey cobalt ore*, containing arsenic, iron, cobalt, and silica; and *glance cobalt*, which is a double bisulphide of arsenic and cobalt. All the ores of cobalt contain more or less nickel.

Cobalticyanogen. (*See* CYANOGEN.)

Cobaltine, *ko-bawlt'-een*, an arsenical ore of cobalt, also containing sulphur. It occurs in reddish silver-white trapezohedral crystals, at the mines of Wehna, in Sweden. It contains from 33 to 37 per cent. of metal.

COB-NUT. (*See* HAZEL-NUT and HOT-NUT.)

COBRA DI CAPELLO. (*See* HOODED SNAKE.)

COCA. (*See* ERYTHROXYLON.)

COCCO, *kok'-ko*. (*See* EDDOES.)

COCCOLOBA, *kok-ko-lo'-ba* (Gr., *kokkos*, a berry; *lobos*, a lobe), a genus of plants belonging to the natural order, *Polygonaceæ*. From the leaves, wood, and bark of *C. uvifera*, a very astringent extract, commonly known as Jamaica kino, is obtained. The fruit, called the seaside grape, has an agreeable acid flavour.

COCCOSTEUS, *kok-kos'-te-us* (Gr., *kokkos*, berry; *osteon*, bone), a fossil fish peculiar to the Devonian measures, so named from the small berry-like tubercles with which the plates of its cranial buckler and body are thickly studded. The remains found in the Caithness flagstones show that its length was from a few inches to about two feet, and it was nearly related to Cephalaspis. (*See* CEPHALASPIS.)

COCCULUS INDICUS, *kok'-u-lus in'-di-kus* (Latin, Indian berry), the fruit of the *Anamirta paniculata* (which *see*). It has some resemblance to the bay-berry, and is imported into this country from the Eastern archipelago. Cocculus indicus is chiefly used for adulterating cheap beer. Its use has been forbidden by Act of Parliament under a penalty of £200 to the brewer, and one of £500 to the druggist who sells it to a brewer. In large dozes it is poisonous to all animals, and it has long been used by poachers for stupefying fish and game. In medicine it has been employed as an external remedy for certain skin diseases. It owes its active properties to a very poisonous crystalline alkaloid called *picrotoxine*. The names *Levant nut* and *Bacca orientalis* are sometimes applied to this narcotic berry.

COCCUS, *kok'-kus*, a genus of insects of the order *Hemiptera*, the type of a family allied to the aphis. They are sometimes known as scale insects. The destructive coffee-bug belong to this family. The males have two wings, but the females are wingless. The females of some of the species yield valuable and beautiful dyes.

COCHLEARIA, *kok-le-air'-e-a* (Lat., *cochleare*, a spoon), a genus of plants, so named from the leaves being spoon-shaped, belonging to the natural order *Cruciferæ*. The species *C. officinalis* is the common scurvy-grass, an indigenous annual found in muddy places near the sea-shore. It has white flowers, which blossom in April and May. When rubbed, it evolves a pungent odour, and its taste is acrid and penetrating. It is esteemed for its antiscorbutic properties.

COCK, DOMESTIC, *kok* (Sax., *coc*; Fr., *coq*) (*Gallus domesticus*). At what period of the world's history this valuable bird was brought under the control of man, it is almost impossible to determine. Without doubt, they were well known over many parts of Europe and Asia many hundred years before the Christian era. Our domestic cock is supposed to be derived from the Jago cocks (*Gallus giganteus*), a large and wild species inhabiting the island of Sumatra, and from the species *Bankiva*, another primitive bird found in the Javan forests. The domestic cock has his head surmounted by a notched crimson fleshy substance, called a comb; and under the throat hang two other pendulous fleshy bodies, called wattles. In both sexes there is below the ear an oblong spot, the interior of which is reddish and the remainder white. The feathers arise in pairs from each sheath, touching by their points within the skin, but diverging in their course outwards. On the neck the feathers are long and narrow; on the rump they are of the same form, but droop laterally over the extremity of the wings, which are quite short, and terminate at the origin of the tail, the plumes of which are vertical. In the centre of the cock's tail are two long feathers, which fall back in a graceful arch. When the cock reaches the age of six months, he attains maturity, and his powers remain undiminished till he is three years old. Then, if younger male birds be about, he will find himself slighted by his numerous wives, and be compelled to yield to a rival the empire of the yard. The domestic cock is one of the most combative, jealous, and arrogant, as well as the handsomest of birds.

COCKATOO, *kok-a-too'*, a genus of birds of the parrot family, but with greater height and different curve of the bill, and a lengthened and broad tail. Cockatoos (*Plyctolophia*) are confined to the Eastern Archipelago and Australia; in the latter country they are very abundant. Like others of their congeners, they make their nests in decayed trees; indeed, if the tree should not be very much decayed, it makes little difference to the cockatoo, who can speedily dig for himself a hole in the trunk with his iron-like bill. They are easily tamed, and learn to imitate the human voice in some respects, although with little accuracy. The name cockatoo is taken from the peculiar cry of the bird. Of this there are several species:—*Broad*, or *Rose-crested Cockatoo* (*Psittacus cristatus*).—This is the largest of the cockatoos, being about two feet in length. It is distinguished from the other species, not only by its size, but also by its crest, which is arched over the head, and of a bright orange-red colour beneath. The general colour of this bird is white, with a pink tinge. It is sometimes domesticated. *Great Sulphur-crested Cockatoo* (*Psittacus galeritus*).—This species is at the same time the handsomest and most common of the family. Its plumage is white, tinged with yellow on the tail and orange or lemon-colour on its crest, which is pointed, and about seven or eight inches in length. In Australia, these birds abound in large flocks of thousands in number. They commit frightful havoc in the corn-fields, and the sight of this handsome bird is sufficient to create the utmost dismay in the mind of the agriculturist, who knows too well the affinity betwixt ripe corn and the lemon-crested cockatoo. *Lesser Sulphur-crested Cockatoo* (*Psittacus sulphureus*). — Greatly resembling the preceding, only some few inches smaller. It is a native of the Moluccas; but of its habits little or nothing is known. It is very pretty, affectionate, and good-tempered, a rare combination of excellent qualities. Another species, very rare, is about fifteen inches in length, of a white colour, tinged with pink.

COCKCHAFER, *kok'-chai-fer* (Ang.-Sax.), (*Melolontha vulgaris*), a well-known species of beetle, belonging to the *Lamellicornia*. It is very common throughout the greater part of Europe, and in this country is particularly abundant. In its larva state it lives for nearly four years, and feeds, very voraciously, on corn, &c. The perfect insect has an exceedingly short existence, sometimes living only a week, and occasionally so long as a month, after arriving at maturity. At this stage it feeds on the leaves of various trees; and, at certain times, commits frightful ravages in agricultural districts. It is about an inch in length, of a black colour, with a whitish down, and the sides of the abdomen are marked by triangular spots.

COCKER, a small spaniel, very similar to the Blenheim. It is used in pheasant and woodcock shooting.

COCK OF THE PLAINS (*Tetrao*, or *Centrocercus urophasianus*), the largest of the North American species of grouse, but smaller than the capercailzie of Europe. (*See* CAPERCAILZIE.) It is a very handsome bird.

COCKLE, *kok'-l* (*Cardium*), a genus of Mollusca, belonging to the *Cardiaceæ*. There are numerous species of this animal, some two hundred of which are known. The structure of the cockle is somewhat curious; it has two adductor muscles, which serve the animal to draw the valves of the shell together. Its foot is very large, compared with the size of the animal, and bent in the middle. This member is not only used for the purpose of progression, but also for excavating holes in the mud and sand in which it lives. By suddenly straightening the foot, the cockle moves with a jump. As the foot is smaller than the shell, it may appear a little singular how it is enabled to bore a hole sufficiently large to admit the whole animal. This is accomplished by distending the foot with water, and then, by a rotary motion, the seemingly impossible feat is easily achieved.

COCKROACH (*Blatta*), a genus of orthopterous insects, very commonly, but incorrectly, called the black beetle. (*See* BLACK BEETLE and BLATTIDÆ.) The American cockroach, the kakerlac, has made its way into Europe. A small species of the insect (*B. Lapponica*), is very common and destructive in Lapland.

COCKSCOMB, *koks'-kome*, an annual plant (*Celosia cristata*) of the natural order *Amarantaceæ*. It is a native of the East Indies, but is cultivated in this country in conservatories and warm borders. It presents a mass of beautiful flowers, forming a kind of crest, and generally of very brilliant hues.

COCK'S-FOOT GRASS, a genus of grasses, having the panicle of flowers much on side of the stem, common in all the northern continents, and very abundant in Britain, and much liked by cattle. In America it is known as orchard grass.

COCOA, OR CACAO. (*See* THEOBROMA.)

COCOA, OR COCOA-NUT. (*See* COCOS.)

COCOA-NUT BEETLE, a large beetle (*Batocera rubus*) of the family *Longicornes*. They are repulsive in appearance, but are eaten with relish by the coolies of the East. The larvæ are very destructive in cocoa-nut plantations.

COCOON, *kok-oon'* (Fr., *cocon*), the silky tissue or envelope which the larvæ of many insects spin, as a covering for themselves immediately before passing into the pupa form. The name is also given to coverings made of other materials. Some caterpillars work into the silky envelope the hairs which cover their bodies; other imbed in the network a leaf, or several leaves fastened together. The larvæ of some insects produce the silken substance of which the cocoons are formed in much greater quantity than others. One of the most useful producers is the ordinary silkworm, whose cocoon is a close and compact oval ball, surrounded with a gauze-like glossy covering. It consists of one long continuous thread, sometimes a thousand feet long. Some parts of the thread are weaker than others; but the greater portion can be unwound as easily as a ball of cotton thread. Different insects vary in the time occupied in spinning their cocoons: several days are spent by the silkworm in this task. In covering the pupa, many insects proceed with an almost mathematical nicety with regard to the direction and disposition of their threads.

COCOS, *ko'-kos* (Gr., *kokos*, a kernal), a genus of Palms *C. nucifera*, the cocoa or cocoa-nut palm, is perhaps the most useful member of the great family.

COD, *kod* (Ang.-Sax.), a fish of the family *Gadidæ*, and scientifically known as *Gadus Morrhua*, or *Morrhua vulgaris*. It sometimes attains a length of nearly three feet, and specimens weighing a hundred pounds have been caught. It is a very favourite article of food, and, salted, is in great demand during the season of Lent. The reproductive power of the fish is extraordinary. The roe of the female generally contains five or six millions of eggs. For more than four centuries has the cod-fishery been carried on without any interruption; yet the supply at the present day is something enormous. A single fisherman has been known to capture 500 of this fish in a day of ten hours. The fishing is carried on by means of lines and hooks. Our great supply of cod is from the banks of Newfoundland; but the cod-fisheries off our own eastern coast, and near the coasts of Scotland, Sweden, and Iceland, are by no means insignificant. The cod fisheries of the United States are chiefly carried on from Massachusetts and Maine.

CODARIUM, *ko-da'-re-um* (Gr., *kodarion*, a leathern pouch), a genus of plants belonging to the natural order *Leguminosæ*, sub-order *Cæsalpinieæ*. *C. acutifolium*, and *obtusifolium*, both natives of Sierra Leone, yield fruits known as the brown and the velvet tamarinds.

CODLIN, *kod'-lin*, a name given to many varieties of apples best adapted for culinary purposes.

Codlin Moth, a small moth (*Pyralis pomona*), very injurious to the apple, in which it deposits its eggs.

CO-EFFICIENT, *ko-ef-fish'-ent*, in Algebra, the known or constant factor of an unknown quantity.

CŒLENTERATA, *se-len-ter-ai'-ta* (Gr., *koilos*, hollow, *teras*, an anomaly), one of the two sub-kingdoms into which the *Radiata* of Cuvier have recently been divided. It corresponds to the class *Polypi* of former writers, and includes most of those curious stationary creatures which are introduced into marine aquaria; as the sea-anemones and sertularia.

CŒLOCLINE, *se'-lo-kline*, a genus of plants belonging to the natural order *Anonaceæ*. The species *C. polycarpa* is the herberine, or yellow-dye tree of Soudan. When reduced to a coarse powder, the bark is a remedy in the treatment of ulcers.

COFFEE, *kof'-fe* the product of one species of a genus of plants belonging to the natural order *Cinchonaceæ*. The species *C. erabica* is the coffee plant, the seeds of which, when roasted and ground, are used to prepare the daily and most cherished drink of probably more than a hundred millions of human beings. The plant is a native of Arabia Felix and Southern Abyssinia. From the former region it has been carried to various countries within the tropics, and, at the present time, it is cultivated wherever the climate is suitable. In some countries it seldom attains a greater height than eight or ten feet; but in others, its average height, when full grown, is from fifteen to twenty feet. It is covered with dark, smooth, shining, and evergreen foliage. It is raised from the seed in nurseries, and is transplanted when about six months old. In three years it comes into full bearing, and, under favourable circumstances, will continue to bear for twenty years. It blossoms throughout the year, so that mature fruit and opening flower-buds may be seen at the same time. The roasted seed or bean has been used to form a beverage in Abyssinia from time immemorial. In Persia it is known to have been in use as early as the year 875. From Abyssinia it was introduced into Arabia in the beginning of the 15th century, and about the middle of the following century it began to be used in Constantinople, where it soon became an article of general consumption. Nearly 80,000 tons are annually imported into Great Britain. The Arabian, or Mocha coffee, is small, and of a dark yellow colour; the Javan and East-Indian are larger and of a paler yellow; the Ceylon, West-Indian, and Brazilian have a bluish or greenish-grey tint. Coffee owes its valuable properties chiefly to the presence of an alkaloid called *caffeine*, and a volatile oil. It is remarkable that tea should contain precisely the same principle, *theine* and *caffeine* being identical. The sensible properties and effects of coffee, like those of tea, are too well known to require to be stated in detail. It exhilarates, arouses, and keeps awake; it counteracts the stupor occasioned by disease, by fatigue, or by opium; it allays hunger to a certain extent; gives to the weary increased strength and vigour, and imparts a feeling of comfort and repose. Its physiological effects upon the system, so far as they have been investigated, appear to be, that, while it makes the brain more active, it soothes the body generally, makes the change and waste of matter slower, and the demand for food in consequence less. In Sumatra and some of the neighbouring islands an infusion of the roasted leaf is used as a substitute for tea, and is called coffee-tea. The leaf contains the same principles as the seed, and therefore has analogous properties. Besides the real *C. arabica*, some other species are cultivated for their seeds; as *C. Benghalensis*, grown in Nepaul; *C. Mozambicana*, on the coast of Mozambique; and *C. mauritiana*, in the Mauritius.

Coffee Bug, an insect (*Lecanicum Coffeæ*) of the Coccus family, which is extremely destructive in coffee plantations.

COINCIDENCE, *ko-in'-si-dens*, in Geometry, the similarity in size and shape of two separate figures.

COIR. (*See* COCOA-NUT FIBRE.)

COLCHICUM, *kol'-tshe-kmu* (after *Colchis*, its native country), a genus of plants belonging to the natural order *Melanthaceæ*. The most important species is *C. autumnale*, the common meadow-saffron. It blossoms during the months of August and September, its flowers being crocus-like, and of a purple colour. This plant offers a strange contrast to most others in the mode of producing flowers and fruit. The flowers appear during the autumnal months named, rising from the ground without any leaves; and, when they fade, nothing further is seen of the plant until the following spring, when tufts of leaves make their appearance, inclosing the seed-vessel or capsule, which ripens about hay-harvest. Both the seeds and corms of this plant are employed medicinally in gout and rheumatism.

COLD. (*See* CATARRH, HEAT, TEMPERATURE.)

COLEOPTERA, *kol-e-op'-ter-a* (Gr., *koleos*, a sheath; *pteron*, a wing), the name applied to an order of insects possessed of four wings, the external pair not being formed for flight, but as sheaths for the interior pair. The coleoptera comprehend all the Beetle tribe. The larvæ of coleopterous insects undergo a complete transformation; those which burrow in the ground generally prepare for the pupa state by removing the earth that surrounds them, so as to form an open oval space; others form a kind of cocoon or web round them; and some assume the perfect state without any sort of preparation. Although some of these insects may be injurious to vegetation, taken as a whole, there can be no doubt that their existence is conducive to man's comfort, and in some cases to a much greater extent than he suspects. Thus, the tiger-beetles (*Cicindelidæ*), the predacious ground-beetles (*Carabidæ*), the diving-beetles (*Dytiscidæ*), the lady-birds (*Coccinellidæ*), and many others, do mankind great service by preying upon caterpillars, plant-lice, &c., while the many dung-beetles (*Copridide*, *Histeridæ*, *Geotrupidæ*, &c.) do good work as removers of carrion and as scavengers generally. Others there are which subsist on the various poisonous fungi; and others, again, which attack dead but still standing trees. There are many thousand species; and many of those in tropical regions are remarkable for their splendid metallic tints.

COLEWORT, *kole'-wurt*, a name given to some of the many cultivated varieties of *Brassica*, generally to those which, unlike cabbages, have open heads of leaves.

COLIBRI. (*See* HUMMING BIRD.)

COLIC, *kol'-ik* (Gr., *kolon*, the colon), a name given to several diseases which are characterized by severe pain of the bowels, with distension or flatulence, but without looseness or diarrhœa. Medical men distinguish no fewer than seven different kinds of this complaint. Among the most frequent causes of this disease may be named poisonous or unwholesome substances, long-undigested food, redundancy of vitiated bile, intense cold, worms, &c.

COLLAPSE, *kol-lapse'* (Lat., *collapsus*, from *collabor*, I shrink down), is a wasting or shrinking of the body, or of a part of it, or a sudden and extreme depression of its strength and energies.

COLLYRIUM, *kol-lir'-i-um* (Gr., *kollurion*), a term formerly applied to any medicament employed to restrain defluxions; but it is now confined to topical remedies for disorders of the eyes;—an eye-salve, or eye-wash.

COLOCASIA, *kol-o-kai'-se-a*, a genus of plants belonging to the natural order *Araceæ*. The species *C. esculenta* and others have large fleshy corms, which are much used as food in Madeira and the West Indies, where they are known as *cocoes*, *eddoes*, or *yams*. (*See* DIOSCOREA for the true yams.) *C. himalensis* has also edible corms, which are used as food in the Himalayas.

COLOCYNTH, *kol'-o-sinth* (Gr., *kolokunthis*), the bitter cucumber or bitter apple, a well-known drastic hydragogue cathartic. It is the fruit of the *Citrullus colocynthus*, a plant belonging to the natural order, *Cucurbitaceæ*, and supposed to be the "wild vine" of the Old Testament. Two kinds of colocynth are known in commerce; namely, *Turkey*, or *peeled colocynth*, which is imported from the Levant, the north of Africa, and Spain, and *Mogadore*, or *unpeeled colocynth*, which comes from Mogadore. The former is the best, and is generally employed in medicine; the latter being principally used by chemists for their show-bottles. The seeds possess the purgative property to a slight extent; but the pulp is by far the most active part of the fruit. In large doses, colocynth is an irritant poison. It owes its properties to a peculiar bitter principle, which has been named *colocynthin*; and it is generally administered in the form of pills, and associated with aloes, scammony, and sometimes calomel.

COLOGNE EARTH, *ko-lone'*, an earthy mass of lignite, occurring in a large irregular bed forty or fifty feet thick, near Cologne and is composed of wood partially fossilized. When livigated, it forms a pigment of a brown colour.

Cologne Yellow, a pigment composed of yellow chromate of lead, and sulphate of lead and gypsum.

COLON, *kol'-lon* (Gr., *kolon*, a member or limb), is the largest of the intestines, or, rather, the largest division of the intestinal canal. This canal is divided into the small and great intestines. The colon is divided into four parts—the ascending, transverse, descending, and the sigmoid flexure. The colon, in man, averages from 4 to 5 feet in length, and about 2 inches in diameter, being about a fourth part as long, and twice as wide, as the small intestine. The canal is not smooth and uniform, as in the small intestines, but bulges out between the bands of muscular fibre into various prominences, more or less regular in their form, in which the fæces lodge for a time, and become deprived of much of their moisture as they are rolled onwards by the peristaltic action. The colon is enveloped in the serous membrane called the peritoneum, which forms the external covering of all the abdominal viscera. (*See* INTESTINES.)

COLQOUINTIDA. (*See* COLOCYNTH.)

COLORADO BEETLE, *kol-o-ra'-da*, a small beetle (*Doryphora decemlineata*) of a yellowish colour, with ten black lines (whence the name) running down the wing-covers. The larvæ are most destructive, and have greatly injured the potato crop of America. Extraordinary precautions have been taken to prevent the arrival of the "potato beetle" in this country.

COLOSTRUM, *kol-los'-trum*, the first milk yielded by the breast of a woman after delivery.

COLOUR, *kul'-ur* (Lat., *color*).—The source of all colour is light, as may readily be seen on calling to remembrance the colourless and almost indistinguishable appearance of objects in a room from which the light has been nearly entirely excluded. When the light is wholly shut out, all is dark, and we cannot distinguish anything in the room; but as it is gradually re-admitted, we begin to recognize the forms of objects, all of which appear to be of a dark neutral tint, and at last, when the sun's rays, or rays of artificial light, are permitted to illumine the apartment, everything appears in its proper and peculiar colour. The pure white light of the sun can be separated by a simple experiment (*see* DISPERSION, RAINBOW, PRISMATIC COLOURS, and SPECTRUM) into tints which range in the following order:—red, orange, yellow, green, blue, violet, and indigo. These tints were supposed to be the primitive colours; but it is now known that light consists of rays of the three *primitive colours*, red, blue, and yellow, and that the others, which were originally ranked among the primitive colours, are in reality *secondary* or *complementary colours*, formed by the union of any two of the primitive tints. Now, when the sunlight falls on any object, it either reflects or absorbs the whole of the rays of which light is composed, or it reflects some and absorbs the remainder. When the whole of the incidental light is reflected, the object, if it be unpolished, appears to be white; if all the rays are absorbed, it seems to be black; but if part of the rays are absorbed and part reflected, it appears to be of the colour of those rays that are reflected; thus, simply, if all the rays except red are absorbed, and the red rays only are reflected, the object will appear to be red; if all except the blue rays are absorbed, it will seem to be blue. All variations of colour are produced by the reflection of certain rays in combination: thus, if the surface of any object or material absorbs all the red rays, reflecting those of blue and yellow, these will form green by combination, and the article will reflect or scatter rays of a green tint, and appear of a green colour. When light, therefore, falls on any body, if it be polished, the rays are almost entirely reflected; but if its surface be without polish, and opaque, a part of the rays of which light is composed are absorbed, and part reflected, which causes the surface to assume the apparent colour which it presents to our sense of sight.

COLOUR BLINDNESS is a curious defect of vision, from which the eye is incapable of distinguishing colours. It is of three kinds: (1) An inability to distinguish any colour, properly so called, the person being only able to distinguish white and black, light and shade. (2) An inability to distinguish between the primary colours, red, blue, and yellow, or between these and the secondary or tertiary hues, such as green, purple, orange, and brown. (3) Inability to distinguish nicer shades and hues, as greys and neutral tints. The first form is rare; the second and third are common. This peculiar defect of vision was formerly known as "Daltonism," from the the circumstance that the famous chemist and originator of the atomic theory, John Dalton, was so affected. The story of his selecting and wearing a scarlet coat (albeit he was a member of the Society of Friends), in utter unconsciousness that it was not of a sober hue, will be found in every memoir and notice of him. It is asserted on the highest authority, that very nearly 5 per cent. of men in this country are more or less affected with colour-blindness, and it is a curious fact that the defect is almost confined to the male sex, for only about one woman in every 4,000 is colour-blind. Of deaf-mutes, about 13½ per cent. are colour-blind, and it is a remarkable fact, that there is with some persons a notably analogy between sounds and colours, many instinctively associating musical notes with certain colours, almost being able, as one person remarked, to "paint a tune." The most prevalent, and, in the interest of public safety, the most serious form of this disease, or optical disorder, is that of the inability to distinguish between red and green, the colours principally used in railway and maritime signals. (*See* SIGNALS.) So-called "violet-blindness" is comparatively unimportant so far as railway servants and sailors are concerned. Professor Holmgren, of Sweden, and Dr. William Thomson, an eminent oculist of Philadelphia, have devised methods of testing the ability to distinguish colours by the use of a large number of skeins of worsted of various colours. Professor Holmgren proposes that a quantity of skeins of Berlin wool (his entire gamut of colour contains 150 different shades) shall be presented to the person to be examined. These are spread out on a white cloth in bright daylight. The examiner picks out a skein of the test colour, lays it down on a clear space on the cloth, and requests the candidate to select from the rest all those skeins which match the sample in colour, and to place them by the side of it. Dr. Thomson employs only 40 skeins of wool, and his method is very efficacious in indicating those persons whose vision is imperfect.

COLOURING MATTER, *kul'-ur-ing*. Most vegetable substances contain colouring matter that can be separated from them. Many of them are used as dye-stuffs. Colouring matters which are capable of fixing themselves to fabrics without the intervention of any other substance, are called *substantive colours*; those which require a mordant are called *adjective colours*. The colouring matter of animal substances appears to be due in a great measure to iron. In minerals colour results from a variety of different elements—iron, chromine, and copper appearing to play the largest part in painting the earth.

COLTSFOOT. (*See* TUSSILAGO.)

COLUBER, *kol'-u-ber*, a genus of serpents, including a vast number of species, but agreeing in respect of having a double row of plates on the under side of the tail. None are of very large size. The common ringed snake (*Natrix torquata*) is the only British species.

COLUMBARIA, *ko-lum-bair'-i-a*, a sepulchral chamber used by the Romans to receive the ashes of bodies which had been burned; and so named from the resemblance of the niches in the walls to the spaces in a dovecot, "pigeon-holes" in modern language.

COLUMBIDÆ, *kol-um'-bi-de* (Lat., *columba*, a dove), a family of birds comprising the pigeons, doves, and turtle-doves. The *Columbidæ* are chiefly remarkable for the way in which they feed their young. The bird's crop is furnished with numerous glands, which, in both sexes, become developed during incubation. These glands secrete a sort of milky substance, with which the food that passes into the crop is moistened. Saturated with this fluid, the food is regurgitated by the old birds for the nourishment of the young. (*See* DOVE, PIGEON.)

COLUMBINE, *kol'-um-bine*, a genus of plants (*Aquilegia*), of the natural order *Ranunculaceæ*. The common columbine grows wild in this country, and is also cultivated in gardens. It is generally three or four feet high, and is a perennial.

COLUMELLIACEÆ, *kol-u-mel-le-ai'-se-e*, a small natural order of dicotyledonous plants in the sub-class *Corolliforæ*, natives of Mexico and Peru.

COLYMBIDÆ, *ko-lim'-bi-de*, a family of web-footed birds, distinguished by short wings, legs placed so far back that an erect position is necessary when standing, and a compressed bill pointed at the tip. The loons, divers, and grebes belong to this family.

COMA, *ko'-ma* (Gr., *koma*, from *koe*, I lie down), a diseased condition of the brain, manifesting itself in a state of insensibility resembling sleep, from which the patient cannot be aroused, or only in a very partial degree. Coma may result from congestion or hæmorrhage in the brain, or from any abnormal pressure on that organ; from the agency of narcotic poisons or alcohol; from exhaustion arising from the loss of blood, or from the action on the blood of various morbid products generated within the system. Slight coma differs but little from profound sleep; but in complete coma the patient is entirely shut off from the external world, and is quite dead to all external impressions. Medical writers distinguish several varieties of coma, the chief of which are the *coma vigil* and the *coma somnolentum*. The former is characterised by a constant disposition to sleep, without falling into a quiet, sound, or natural slumber, accompanied by delirium, muttering, and agitation; the latter is marked by profound sleep, without the power of awakening spontaneously, and, if roused, almost immediately sinking into the same state. Any of the forms of coma may come on suddenly, and terminate speedily in death; or they may come on gradually, and be of short duration, sense and voluntary motion as slowly returning. When its accession is slow, it often commences with drowsiness or headache. The causes and characteristics of this disease being so various, its treatment must also necessarily vary; generally, the object is by means of stimulants and counter-irritants to arouse the patient to consciousness. Coma can be produced by mesmeric influence. (*See* MESMERISM.)

COMA BERENICES, *ko'-ma be-re-ni'-ses* (Lat., hair of Berenices), a small and close cluster of stars south of the tail of Ursa Major.

COMBRETACEÆ, *kom-bre-tai'-se-e*, the Myrobalan family, a natural order of dicotyledonous plants, in the sub-class *Calyciflora*. There are 22 genera and about 200 species, which are exclusively natives of the tropical parts of America, Africa, and Asia. The order is remarkable for the presence of an astringent principle, which renders the barks of some species, and the fruits and flowers of others, useful for tanning and dyeing. Some yield excellent timber. *Combretum butyrosum*, a native of South-Eastern Africa, produces a kind of vegetable wax, which is called *chiquito* by the Caffres, who make use of it to dress their victuals. (*See* TERMINALIA.)

COMBUSTION, *kom-bust'-shun* (Lat., *comburo*, I burn), a term applied to the phenomenon that takes place when chemical action is sufficiently intense to produce light and heat. Gases are sometimes divided into combustibles and supporters of combustion. The idea conveyed by such a classification is an erroneous one. Air is taken to be a supporter of combustion, and hydrogen gas burning in it as a combustible; but if the conditions are reversed, we are obliged to alter our classification; for a jet of atmospheric air may be burnt in an atmosphere of hydrogen.

Combustion, Spontaneous Human, is a subject that has from time to time given rise to a considerable amount of discussion among its believers and disbelievers. Numerous apparently well-authenticated cases are given of this phenomenon; but the difficulties of accounting for the chemical changes involved in such a case have caused many eminent persons to reject the whole matter, and contend that none of the cases have been sufficiently well authenticated. The cause to which it is usually traced is gross intemperance. The flame is described as of a bluish colour, obscure in the light, and extinguished with difficulty by water. Sometimes the body is said to have been consumed so as to crumble to pieces when moved, without the clothes being burned; in other cases the combustion has extended to neighbouring objects. The ashes are always a fatty kind of soot; and a similar greasy matter, of fœtid odour, is deposited on objects around.

COMET, *kom-et* (Gr., *kometes*, from *kome*, hair), in Astronomy, the name given to luminous celestial bodies which occasionally appear in the heavens, consisting of a round body, termed the head, to which a long stream of light is generally appended, called the tail, which stretches across the heavens for some considerable distance. The head consists, for the most part, of an ill-defined luminous haze, with a bright mass of light in the centre, called the nucleus, which resembles a star or small planet in apparent size and appearance. The tail is a long train of light, streaming out like hair behind the head, whence the name comet. In some comets, the head is without any nucleus whatever, and others have the luminous head without any tail appended to it. The tail is often of great length; that of the comet of 1858, called Donati's comet, being about 50,000,000 miles in length, while that of the comet of 1843, one of the most brilliant ever observed, was quite three times as long. These bodies travel round the sun in the path of an ellipse, having the sun as one of its foci, or in a parabolic curve. They are only seen when they are at their perihelion, and the tail is always turned away from the sun. Comets differ considerably from each other in form, some being without any tail, as it has been said; but they generally have a broad, luminous tail, slightly curved in shape, which trails behind the head. They were supposed by the ancients to prognosticate some disastrous event, and they were considered to be within the region of the atmosphere that surrounds the earth. Newton showed that they travelled in elliptical orbits of great eccentricity, the curvature of which did not differ much from that of a parabola. Considering this to be the case, and assuming the path of the comet of 1682 to be parabolic in form, the astronomer Halley calculated its orbit from Newton's observations, and predicted its reappearance about the end of 1758 or the early part of 1759, making allowances for the disturbing action of the planet

Jupiter. Halley's prediction was verified. When it reappeared, it was first observed on Christmas-day, 1758, by a German astronomer, and it passed its perihelion in March, 1759, thus adding to Halley's fame as an astronomer, and confirming the theory that Newton had advanced respecting the revolution of these bodies. This comet, now known as Halley's comet, which had been noticed in 1378, 1456, 1531, 1607, 1682, and 1759, appeared again in 1835, and, assuming seventy-six years to be the mean time that elapses between its successive appearances at its perihelion, it will be seen again in 1911. A description of the principal comets that are known to return to their perihelion at fixed periods will be found elsewhere (*see* BIELA'S COMET, ENCKE'S COMET), as well as an account of the great comet of 1858. (*See* DONATI'S COMET.) The comets of Faye, Brorsen, and D'Arrest, discovered in 1843, 1846, and 1851, respectively, have also reappeared at the time calculated for their return to their perihelion. A splendid comet was visible in June and July, 1861. The nucleus was about 400 miles in diameter, with a long tail, travelling at the rate of about 416,000 miles an hour. A strange glare in the atmosphere on the 30th of June led some observers to the conclusion that on that day the earth passed through the tail of the comet. Two comets were visible in Europe in 1881. It is beyond the bounds of possibility to state how many comets there are revolving round the sun, which is the centre of our solar system; but it may be said that more than two hundred have been observed up to the present time, the orbits of which have been calculated. Of these, about fifty revolve in elliptic orbits, and six at least have been observed at several successive appearances at their perihelion. A great number of comets are invisible to the unassisted eye. Mr. Norman Lockyer says:—"The majority of comets that come into our system from outside are attracted toward the sun, pass by it, and then continue on away from our system again; while there are others that belong to our system, and revolve round the sun, as the planets do; only, instead of having nearly circular orbits, their paths are very eccentric, so that the comets approach near the sun at one time, and then recede to immense distances away. The majority go round the sun the contrary way to planets, and are said to have a retrograde motion." With respect to their dimensions, it was ascertained by micrometric measurement that the great comet of 1811, which is supposed to arrive at its perihelion about once in 3,000 years, had a head 1,270,000 miles in diameter, with a nucleus in the centre, the diameter of which was about 2,640 miles, and a tail 100,000,000 miles in length. The nucleus of Donati's comet was 800 miles in diameter, while the diameter of the surrounding nebulous haze was about 100,000 miles, and the tail, 51,000,000 miles at its greatest length. It is not known of what substance comets consist; but it is evident that, whatever it may be, it must be extremely thin, and without any sensible weight, as stars have been observed shining *through* comets with undiminished lustre, which a slight fog would altogether hide from view. The great comet of 1843 was only 475,000 miles distant from the sun at its perihelion, and is considered to have been exposed to a heat more than 2,000 times greater than that of red-hot iron. It is not known what causes the tail of the comet; and scientific speculation is active on the subject. That it is of almost inconceivable tenuity is settled, as stars can be seen through it with no apparent diminution of brightness and as no disturbing effect is exercised by it on the planetary bodies.

COMMELYNACEÆ, *kom-mel-e-nai'-se-e* (after J. and G. Commelin, celebrated Dutch botanists), the Spider-wort family, a natural order of monocotyledonous plants, in the sub-class *Petaloideæ*. There are sixteen genera, which include 200 species, chiefly natives of India, Africa, Australia, and the West Indies. They have flattened, narrow, and usually sheathing leaves. The rhizomes of some species, as *Commelyna tuberosa*, *angustifolia*, and *striata*, contain much starch, and in a cooked state are edible. Some species have been reputed astringent and vulnerary, and others emmenogogue.

COMMISSURE, *kom-mish'-ure* (Lat., *commissura*, a joining together), is a joint or seam, the place where two bodies or parts of a body meet and unite. (*See* BRAIN.)

COMPLEXION, *com-plek'-shun* (Lat., *complecto*, I comprise), a term employed to signify the colour of the face and skin, although properly it means the temperament, and natural disposition of the skin. Formerly, the human skin was supposed to consist of only two parts—the cuticle, or epidermis, and the cutis, or real skin; but Malpighi showed that between these two was a soft gelatinous cellular texture, which he distinguished by the title *rete mucosum*. On this discovery that anatomist offered a suggestion as to the colour of negroes. The *rete mucosum* is of very different colour in different nations; and the difference of its colour corresponds so exactly with the difference of their complexions, that there can be little doubt that it is the principal seat of the colour of the human complexion. Of the different colours observed amongst mankind, Dr. Hunter gives the following view:—Black—Africans under the line, and the inhabitants of New Guinea and New Holland. Swarthy—the Moors in the northern parts of Africa, and the Hottentots in the southern parts. Copper-coloured—the East Indians. Red-coloured—the American Indians. Brown-coloured—the Tartars, Persians, Arabs, Africans on the Mediterranean coast, and Chinese. Brownish—the inhabitants of Southern Europe, Sicilians, Spaniards, and also the Abyssinians in Africa. The Turks, Samoides, and Laplanders, are also brownish. White—most of the European nations, including the Swedes, Danes, English, Germans, Poles, &c., together with the inhabitants of the islands in the Pacific Ocean.

COMPOSITÆ, *kom-poz'-e-te* (Lat., *compono*, *compositum*, I put together), a natural order of dicotyledonous plants, in the sub-class *Corolliflorœ*. It is one of the largest and most important orders in the vegetable kingdom, and its members are to be met with in all parts of the world. In northern regions the plants are generally herbaceous, but in warm climates they sometimes become shrubby, or even arborescent. The following botanical characters clearly define this great order:—The leaves are alternate, or opposite, and without stipules; usually simple, but often much divided. The flowers, which are termed *florets*, are hermaphrodite, or unisexual, are collected in dense heads or *capitula*, each collection of florets being on a common receptacle, and surrounded by an involucre. The separate florets are also frequently furnished with scale-like bractlets, termed *paleæ of the receptacle*. The calyx is superior, closely adhering to the ovary, its limb being entirely abortive, or membranous, or pappose. The corolla is monopetalous, tubular, superior, and usually deciduous; it is ligulate (strap-shaped), bilabiate (two-lipped), or funnel-shaped; and in the latter case, four or five-toothed. The stamens are five in number, rarely four, and are inserted upon the corolla; the filaments are either distinct or monadelphous, and the anthers are united in a tube. The ovary is inferior and one-celled, with a single erect ovule. The style is simple, undivided below and bifid above; the stigmas are placed upon the inner surfaces of the two divisions. The fruit, termed *cypsela*, is dry, indehiscent, one-celled, and crowned with the limb of the calyx, which is often pappose. The seed is solitary, erect, and exalbuminous. The order has been subdivided by De Candolle into the following sub-orders:—1. *Tubuliflorœ*—florets tubular or ligulate, either perfect, unisexual, or neuter; when perfect they are tubular, with five, or rarely four, equal teeth. 2. *Labiatifloræ*—hermaphrodite florets, or at least the unisexual ones divided into two lips. 3. *Liguliflorœ*—florets all ligulate and perfect. The first of these sub-orders includes the sections *Corymbiferœ* and *Cynarocephalœ*, proposed by Jussieu; the last corresponds to the *Chicoraceœ* of the same writer. Plants belonging to the sub-order *Tubulifloræ* abound principally in hot climates. They are remarkable for their bitter, tonic, and aromatic properties. (*See* ANTHEMIS, ARTEMISIA, ARNICA.) A few are used for dyeing. (*See* CARTHAMUS.) Some are cultivated as esculent vegetables, as the *artichoke* and *cardoon*. (*See* these words.) The *Labiatifloræ* are almost confined to the extra-tropical parts of South America. They do not furnish many useful products. The *Liguliflorœ* are most abundant in cold and temperate climates. Their chief characteristic is the presence of a milky, bitter, astringent, or narcotic juice, which possesses alterative, diuretic, aperient, or narcotic properties. The roots of some are esculent, and others, by cultivation with diminished light, become edible, as salads. (*See* CICHORIUM, LACTUCA, TARAXACUM.)

COMPLEMENT, *kom'-ple-ment*, that which completes or makes up a given magnitude and some fixed magnitude. In Arithmetic, it signifies the number by which one number falls short of the next higher number expressible by tens. In mathematics, the complement is the arc or angle by which a given arc or angle falls short of a quadrant or right angle.

COMPOSITE NUMBER, in Arithmetic, is one which can be divided by some other number greater than 1, in opposition to a prime number, which cannot be thus divided. Thus 12, 15, and 27 are composite numbers; whilst 11, 47, 89, are not composite.

CONCHIFERA, *kon-kif'-e-ra* (Lat., *concha*, a shell; *fero*, I bear), the name given by the naturalist Lamarck to certain bivalve shells, whose inhabitants are susceptible of no other impressions save those of immediate contact.

CONCHOID, *kon'-koid*, a curve invented by Nicomedes, and used by the ancients in the construction of solid problems. It had for its objects the trisection of an angle, the construction of two geometrical means between two given lines, and the doubling of the cube. Mechanically the curve may be easily described, and is often used in architecture as a boundary-line of the vertical section of columns.

CONCHOIDAL, *kon-koy'-dal* a term applied to that peculiar fracture of stones and minerals which exhibits convex and concave surfaces. Flint, cannel coal, and glass, are examples of substances possessing a conchoidal fracture.

CONCHOLOGY, the science which treats of shells and the animals inhabiting them. (*See* MOLLUSCA.)

CONCRETIONS, *kon-kre'-shuns*, are hard substances that occasionally make their appearance in different parts of the human body. When formed by chemical precipitation from the fluids, a concretion is known as a calculus. (*See* CALCULUS.) Solid substances, as peas, cherry-stones, needles, &c., accidentally introduced into the body, sometimes become the nuclei of concretions. In some animals, concretions of a large size are formed, and are produced sometimes in horses by the habit of eating the hair on other horses' bodies.

CONCUSSION, *kon-kus'-shun* (Lat., *concutio*, a shaking together), a violent commotion or shock communicated to the brain, or the whole nervous system, by collision of the body with some external object. In its slightest form, a stunning sensation is merely communicated, which passes away in a few minutes; in its severest form, death rapidly ensues.

CONDOR, *kon'-dor* (*Sarcoramphus gryphus*), a large bird of the Vulture species, and the largest of flying birds, the expanse of its wings having been known to reach fourteen feet. The wings are very powerful; the general colour black, with, in the males, great part of the wings white. Around the neck is a white ruff of downy feathers, above which the skin is bare and corrugated. The head of the male bird has a large cartilaginous comb, and there is a dilateable wattle on the neck. It feeds mostly on carrion, and is extremely voracious, sometimes gorging itself so that it cannot fly. It is almost strictly confined to the immense chain of the Andes, as is called the vast mountain-range that runs along the whole west coast of South America. The condor builds no nest, but lays its eggs, which are three or four inches in length and perfectly white, on the bare rocks. (*See* VULTURE.)

CONDUCTORS AND NON-CONDUCTORS OF ELECTRICITY, terms applied to substances according to whether they receive and communicate electricity readily or not. (*See* ELECTRICITY.)

CONDYLURA, *kon-di-lu'-ra* (*Condylura cristata*), a small insectivorous animal of mole-like appearance, found in North America. It is about four inches and a half long, and has a bushy tail more than three inches long. Its head is remarkably large, body thick and short, and nose rather thick, and projecting beyond the mouth. At the end of the nose is a flat star-like process composed of seventeen cartilaginous points. These animals do not make such hills as the European moles do, but only little subterraneous walks, forming banks about four inches broad by two inches thick.

CONE, *koan* (Gr., *konos*), in Geometry, denotes a solid body, which terminates in a point and has a circle for its base. The axis of a cone is a straight line drawn from the apex to the centre of the circle forming the base. When the axis is perpendicular to the plane of the base, the cone is said to be *right;* and when the axis is inclined to the plane of the base, the cone is said to be *oblique*. A *truncated* cone is the lower part of a cone cut by a plane parallel to the base. The area or surface of a right cone, exclusive of the base, is equal to a triangle, the base of which is the periphery, and its height the slant side of the cone, or equal to the sector of a circle whose radius is the slant side, and its arc equal to the circumference of the base of the cone. Every cone, whether right or oblique, is equal to one-third part of a cylinder of equal base and altitude: the solid contents are therefore found by multiplying the base by the altitude, and taking one-third of the product. The centre of gravity of a cone is in the axis, at a distance from the centre of the base equal to one fourth the distance from the vertex. (*See* CIRCLE, CONIC SECTIONS, PARABOLA.)

In Botany, a collective more or less elongated fruit, composed of a number of indurated scales, each of which bears one or more naked seeds. The fruit is seen in the fir, larch, spruce, araucaria, and many other plants of the natural order *Coniferæ*. A peculiar modification of the cone is seen in the cypress and in the juniper, and is termed the *galbulus*. It differs from the true cone in being more or less rounded in form, and in having the heads of the scales greatly enlarged. In the galbulus of the juniper the scales are fleshy, and are united together into one mass, so that it resembles at first sight a berry. The fruits of the Scotch fir and the cypress are familiar instances of the cone.

CONE-SHELL, a family of gasteropodus molluscs of the order *Pectinibranchiata*, having a conical shell. The inhabiting animal, carnivorous, has a proboscis capable of much extension. It is found in banks of sandy mud, chiefly within the tropics, but occasionally in the Mediterranean. The shells are very beautiful, and valued by collectors. Fossil cone-shells are found in the chalk, and in more recent formations.

CONFERVOIDÆ, *kon-fer'-voy-de*, a sub-order of the *Algæ* (which *see*).

CONFORMABLE STRATA, *kon'-form-a-bl*, in Geology, beds which lie parallel to each other.

CONGELATION, *kon-jel-ai'-shun* (Lat., *congelo*, I freeze), the process of passing from a fluid to a solid state, whether through the effect of pressure or the lowering of the temperature. (*See* ICE.)

CONGER EEL, *kong'-gur*.—This fish may easily be distinguished from the fresh-water species of eel by the upper jaw being the longest, and the dorsal fin commencing much nearer the head. It is darker on the upper parts than the common eel, and brighter beneath. There are not many species, and one only (*C. vulgaris*) is a native of the British seas. It attains a very large size, weighing occasionally from seventy to a hundred pounds, and measuring six and eight feet in length. The principal conger-fishery is on the Cornish coast. The fishing takes place at night (the darker the more chance of success), and the ordinary bait is a pilchard. It is dreadfully voracious, and devours even its own species.

CONGESTION, *kon-jest'-shun* (Lat., *congestio*, from *congero*, I amass), is a term employed to denote an unnatural accumulation of blood in the capillary vessels of any part, accompanied with disordered function of the organ in which such accumulation takes place. The organs most liable to congestion are the brain, lungs, and liver; but other parts are also subject to it. It is usual to distinguish two kinds of congestion—a passive and an active. In passive or simple congestion there is merely an accumulation of blood arising from distension and diminished vital energy in the capillaries; in active congestion, on the other hand, the blood-vessels are in a state of inordinate activity, and a preternatural quantity of blood is determined to them. Anything may be the cause of congestion which diminishes the vital energy of the capillaries, or which increases the quantity of blood which they contain. (*See* INFLAMMATION.)

CONGLOMERATE, *kon-glom'-e-rait* (Lat., *con*, together; *glomerare*, to gather in round heaps), a rock composed of rounded and water-worn fragments of stone, bound or cemented together by silicious, ferruginous, or calcareous matter. The component fragments may vary from pebbles the size of a pea to boulders half a ton in weight. Some conglomerates are commonly known as *pudding-stones*, from the resemblance of the pebbles in the mass to the fruit in a plum-pudding.

CONIC SECTIONS, *kon'-ik sek'-shuns*, the curves formed by the intersection of a right or oblique cone and a plane. If the cone is cut by a plane parallel to the base, the section is a *circle;* if the section is made obliquely, that is, nearer to the base at one end than the other, a curve is obtained which is called an *ellipse;* if the section is made parallel with the axis, perpendicular from the vertex, or so as to make a greater angle with the base than is made by the side of the cone, the curve obtained is called a *hyperbola;* and if the section is made parallel with one side of the cone, the curve is called a *parabola*. (*See* various headings.) The ancient Greeks investigated the properties of conic sections with great acuteness; and a work on them is still extant, written by Apollonius of Perge.

CONIFERÆ, *ko-nif'-e-re* (Gr., *konos*, a cone; Lat., *fero*, I bear), the Pine family, a natural order of dicotyledonous plants, in the division *Gymnospermia*—resinous trees, or evergreen shrubs, with branched continuous stems. The leaves are needle-shaped or lanceolate, parallel-veined, fascicled, or imbricate. The flowers are naked (without floral envelopes), and monœcious or diœcious, the male flowers being arranged in deciduous amenta, and the female flowers in cones. The fruit is either a cone or a galbulus. The seeds are naked, hard externally, and albuminous, with two or many cotyledons. The plants of this order abound in temperate climates, and also occur in cold and tropical regions. There are about 30 genera, which include about 120 known species. They possess very important properties; many supply valuable timber, and most of the species contain an oleo-resinous juice, or turpentine, which is composed of a volatile oil and resin. (*See* ABIES, PINUS, JUNIPERUS, CEDRUS.)

CONIROSTRES, *ko-ni-ros'-tres*, birds of the order *Insessores*, including finches, sparrows, starlings, linnets, larks, crows, and many other well-known birds, characterised by strong conical bills, and feet adapted for walking on the ground as well as perching.

CONIUM, *ko'-ne-um*, the Hemlock, a genus of plants belonging to the natural order *Umbelliferæ*. The most important species is *C. maculatum*, an indigenous plant, which is extensively employed in medicine to relieve pain, relax spasm, and compose general nervous irritation. It owes its properties chiefly to the presence of a colourless oily liquid, with a penetrating mouse-like odour, to which the name of *Conia* has been given. In improper doses hemlock is a powerful poison, and many fatal accidents have arisen from its having been mistaken for harmless umbelliferous plants; it may, however, be readily distinguished by its botanical characters. The stem is large, round, and smooth, with spots upon it of a purplish-black colour; the leaves are dark green, and shining; the general involucre consists of from three to seven leaflets, the partial involucre of three leaflets; the fruit has undulated, crenated primary ridges; and the whole herb, when bruised, evolves a disagreeable smell. No chemical antidote is known for hemlock.

CONJUNCTION, *kon-junk'-shun* (Lat., *conjungere*, to join together), when two heavenly bodies have the same longitude or right ascension (*see* ASCENSION, RIGHT), they are said to be in conjunction. If they also had the same declination, or latitude, north or south of the celestial equator, the nearer heavenly body would apparently cover the disk of that which is more remote. When any heavenly body is in a line between the earth and the sun, it is said to be in conjunction with the latter; but it is said to be in opposition to it when the earth comes between the body in question and the sun. Geocentric conjunction is the conjunction of two heavenly bodies as viewed from the earth; but when heliocentric conjunction is spoken of, the conjunction is understood to be considered as if viewed from the sun. True conjunction is the observation at the earth's surface reduced to what it would be if witnessed from the centre of the earth, by which means the observations of astronomers in different parts of the world are made mutually available.

CONNARACEÆ, *kon-na-ra'-se-a*, a natural order of exogenus plants, consisting of trees and shrubs, sometimes climbing, and without resinous juice. Nearly 50 species are known, all tropical. One a native of Guiana, *Omphalobium Lamberti*, supplies the beautiful zebra-wood.

CONSERVATION OF FORCE. (*See* FORCE.)

CONSTANT, *kon'-stant*, in mathematical analysis the quantity which remains the same for all cases in a problem.

CONSTIPATION, *kon-stip-ai'-shun* (Lat., *constipatio*, from *constipo*, I crowd together), a torpid or sluggish condition of the bowels, occasioned by an excessive action of the absorbents of the bowels, or defective secretion of the juices of the intestines, or by an impaired peristaltic action of the intestines. (*See* DIGESTION.) It arises most frequently from a deficiency or vitiated secretion of the bile, which is the natural stimulus of the bowels. Sedentary habits predispose to constipation, as does also the use of certain kinds of food. When severe and obstinate, it gives rise to inflammation of the bowels, and may soon prove fatal. The treatment consists in moving the bowels by means of purgatives, and then restoring the natural state of the system by means of active exercise in the open air, sea-bathing, and the use of food of a laxative nature; as brown bread, green vegetables, &c.

CONSUMPTION. (*See* PHTHISIS.)

CONTAGION, *kon-tai'-jun* (Lat., *contagio*, from *con*, and *tango*, I touch), ought, properly speaking, to be confined to the communication of disease to a healthy body by actual contact with the sick, or with the palpable matter from their bodies, and infection to be applied where disease is communicated through the medium of the atmosphere, or by means of other intermediate substances. This distinction, however, is frequently lost sight of, and the term contagion applied to all cases in which the disease is conveyed to the person of the recipient by particles of matter proceeding from the person of the sick, whether these particles are in a solid or a gaseous form, whether they are imparted by direct contact of the two bodies, or by being wafted through the air, or carried upon articles of clothing. There are two kinds of contagious diseases:—(1) Those that can only be communicated by direct contact, as itch, syphilis; and (2) those which are capable of being produced either by direct contact or without it, as small-pox, typhus, fever, &c. Some contagious diseases seem to effect some radical change upon the system, so that it is not again liable to attack from the same disease, as small-pox; and some diseases, that do not generally manifest any contagious disposition, do occasionally, under unfavourable circumstances, assume a malignant and contagious form. The term contagion is also applied to the poisonous matter by means of which the disease is communicated. In this latter sense, it is a morbific matter *sui generis*, which, on entering the blood, produces a definite train of morbid phenomena, and communicates to the blood the property of generating a similar poison capable of producing precisely the same disease.

CONTORTED STRATA, in Geology, beds which are bent or twisted.

CONVOLVULACEÆ, *kon-vol-vu-lai'-se-e* (Lat., *convolvo*, I roll or bind together), the Convolvulus or Bindweed family, a natural order of dicotyledonous plants in the sub-class *Corolliflorœ*. Herbs or shrubs generally twining or trailing and milky. In this order there are 47 known genera, with about 665 species, which are chiefly found in the plains and valleys of hot and tropical regions. A few flourish in temperate climates, but none in the coldest latitudes. They are remarkable for the presence of an acrid milky purgative juice in their roots. Jalap and scammony are products of this order.

CONVOLVULUS, *kon-vol'-vu-lus*, the Bindweed, a genus of plants, the type of the natural order *Convolvulaceæ*. It is characterised by a bell-shaped corolla, with five prominent plaits and five shallow lobes. Three species are natives of Britain; namely, *C. arvensis*, *Calystegia sepium*, and *C. soldanella*. *C. scammonia*, a native of Asia Minor, is a valuable medicinal plant, being the source of the purgative gum-resin called scammony. This is obtained from the fresh root, by cutting the top obliquely off, and allowing the milky juice which exudes to be collected in shells or other vessels. The root of *C. Panduratus*, is used in America as a purgative. A shrubby specimen, *C. scoparius*, a native of the Canary Isles, yields a wood which has an odour like that of a rose.

CONVULSIONS, *kon-vul'-shuns* (Lat., *convello*, I pull together), a violent and involuntary contraction of the muscles of the human body, generally with corresponding relaxations, but sometimes with rigidity and tension. The fits vary much in extent and violence, sometimes attacking the whole body, at other times only particular parts; sometimes lasting only for a few minutes, at other times continuing for hours. When the affected muscles are rigid and tense, and their contraction persistent or not quickly alternating with relaxation, the convulsion or spasm is said to be *tonic;* when contractions and relaxations rapidly alternate, it is called *clonic;* when slight contractions rapidly alternate with relaxations, it is called *tremor*. Sometimes the attack is sudden and without any warning; but generally it is preceded by certain premonitory signs, such as giddiness, dimness of vision, coldness of the extremities, tremblings, and a cold air creeping up the back or up a limb. During the fit the teeth gnash and often bite the tongue, the eyes roll wildly about, and the whole face is distorted. The muscular force exerted is sometimes so great as to overcome the strength of several attendants. Great languor commonly succeeds, attended frequently with headache and giddiness; but these generally pass quickly away. In partial convulsions the mind is rarely affected; but when general, it is in most cases lost during the fit. The causes of convulsions are many and varied, and their treatment must in each case depend very much upon the cause. Convulsions are exhibited in connection with epileptic attacks. (*See* EPILEPSY.) In children the common cause is irritation of the bowels, arising from indigestible foods, teething, or worms. These are to be treated by the administration of appropriate purgatives and the lancing of the gums. In puerperal convulsions bleeding and opiates are the usual remedies; and in cases where they arise from violent affections of the mind, the exciting causes must be studiously avoided. During the fit the patient should be immediately surrounded as much as possible by fresh cool air, the face, neck, and bosom freely exposed to it, and everything tight about the body loosened. For children a warm bath is strongly recommended. The after-treatment consists in the judicious use of tonics and nervous stimulants, with cold bathing, regular exercise in the open air, plain but nourishing diet, and attention to the state of the bowels.

CONY, OR CONEY, *ko'-ne* (Lat., *caniculus*), an old English name for the rabbit, used in the authorized version of the Old Testament, as a translation of a Hebrew word, which probably referred to the *Hyrax Siniacus*, a small animal about the size of a rabbit. (*See* DAMAN.) Rabbits are not known in Palestine.

CONYZA, *ko-ni'-za*, a genus of plants of the natural order *Compositæ*, sub-order *Corymbiferæ*. One species, the fleabane, or ploughman's spikenard (*C. Squarroso*), is well-known in England, from its peculiar odour, which is said to drive away fleas and gnats.

CO-ORDINATES, *ko-or'-di-nates*, in Geometry, "the method of co-ordinates" is otherwise known as analytical, and sometimes as algebraical geometry. (*See* GEOMETRY.) Co-ordinates are lines so measured off from a fixed point, "the origin of co-ordinates," along fixed lines passing through it, as to determine by their quantities the position of any other point relative to the origin. The method is not capable of demonstration without the use of diagrams. It was invented by Descartes, and is a means by which algebra and the calculus may be employed in geometrical investigation.

COOT, *koot*, a genus of birds (*Fulica*) of the order *Grallæ*. Coots are found in various parts of Europe, Asia, and America, but abound in larger numbers in Holland than elsewhere. The common coot (*F. atra*) is about sixteen inches in length; its upper parts are slatey black, and its under lead-colour, and there is a white bar across the wings. From the bill almost to the crown of the head there is a fleshy excrescence, destitute of feathers, and smooth and round. On this account it is sometimes called the bald-headed coot. In northern regions it is a summer bird of passage. The flesh of the coot, although not a great delicacy, is a good article of food.

COPAIBA. (*See* COPAIFERA.)

COPAIFERA, *ko-pai'-fe-ra* (from *copaiba*, the Brazilian name, and Lat., *fero*, I bear), in Botany, a genus of plants belonging to the natural order *Leguminosæ*, sub-order *Cæsalpinieæ*. The species are natives of tropical America, and several yield the valuable oleo-resin which is used in medicine under the name of *balsam of copaiba*. This is obtained by making incisions into the stems of the trees. Most of the copaiba of commerce is brought from the Brazils, a very little being imported from Guiana and the West Indian islands. It is stimulant and diuretic, and in large doses aperient; and is used in the treatment of affections of the urino-genital system, and in chronic catarrhs. The timber known as the purple-heart, or purple-wood of Guiana, is the produce of *C. pubiflora*, and probably *C. bracteata* also. It is largely employed for making musket ramrods and for ornamental purposes.

COPAL. (*See* HYMENÆA.)

COPALCHE BARK. (*See* CROTON.)

COPERNICAN SYSTEM, is the term applied to that system of astronomy propounded by the celebrated Polish astronomer Nicholas Copernicus, who was the first to affirm that the sun and stars are stationary; that the moon alone revolves about the earth; that the earth is a planet, whose orbit is between Venus and Mars; that the planets revolve about the sun; and that the apparent revolution of the heavens is caused by the rotation of the earth on its axis. (*See* ASTRONOMY, PTOLEMAIC SYSTEM.)

COPERNICIA, *ko-per-nish'-ya*, a genus of palms. The species *C. cerifera*, the Carnahuba palm, is a native of the Brazils. On the lower surface of its leaves wax is secreted, and this is occasionally imported into this country under the name of *Carnahuba* or Brazilian wax.

COPPER, *kop'-per*, one of the six primitive metals. The symbol of this important metallic element, Cu, is an abbreviation of its Latin name *cuprum*, which word is itself derived from that of the island of Cyprus (Gr., *kupros*), where it was first worked on an extensive scale. It was called *Venus* by the alchemists, who gave to it the symbol of that planet. Copper is a hard, sonorous, ductile, and malleable metal, of a characteristic reddish-brown colour. The specific gravity is 8·78 when cast, and 8·96 when rolled or hammered. Very thin films have been obtained, which were of a beautiful green colour by transmitted light, although of the natural colour by reflected light. It is one of the best conductors of heat and electricity, and expands one part in 582 between the freezing and boiling points of water. By slow voltaic reduction, it may be obtained in cubes and octahedral forms, which are also taken by several deposits of native copper. The melting point of copper is 1996° Fah.; and by exposing it to a very intense heat, it boils and volatilizes, burning with a brilliant green flame. Heated to redness in the open air, copper combines rapidly with oxygen; but even moist air at ordinary temperatures has but little effect on it. In sea-water it becomes gradually corroded by the formation of an oxychloride of copper. Nitric acid oxidizes and dissolves it with great rapidity; sulphuric does not act on it at ordinary temperatures, but dissolves it rapidly if heated, sulphurous acid being evolved and oxide of copper formed, which unites with the excess of acid to form the sulphate. Hydrochloric acid dissolves it with access of air; if the air is excluded, no action takes place. It is but little affected by the fixed alkalies; but, with access of air, ammonia slowly oxidizes it.

Compounds of Copper.—There are two oxides, the *protoxide* and the *sub-oxide*, the protoxide is found native in dark steel-grey crystals, but can be prepared artificially by heating copper in contact with the air, or by igniting the sulphate, carbonate or nitrate of copper. It is also prepared by adding caustic potash to a hot solution of a capric salt, and thus formed it is a black powder which melts at a red heat. The sub-oxide of copper occurs native in red translucent crystals; prepared artificially, it forms a beautiful crimson powder. *Proto-chloride* of copper is brown in the anhydrous state, and green when hydrated (*see* ANHYDRIDE); is very soluble in water, forming a beautiful emerald green solution when concentrated, but pale blue when dilute. There are several sulphides of copper, the principal being the *proto-sulphide* and the *bi-sulphide*, corresponding in composition to the oxides. They are both found native, but the proto-sulphide is often formed in analytical operations. The pigment known as blue verditer consists of a hydrated oxide of copper. The salts of copper are characterised by their green or blue colour. They are nearly all soluble, and have a strong, disagreeable, metallic taste, acting as poisons on the human system. The most characteristic reactions of copper salts are as follows: Ammonia in excess gives a dark blue solution; yellow prussiate of potash gives a red-brown precipitate. A strip of bright metallic iron precipitates copper from acid solutions in a metallic form.

Poisoning by Copper.—The symptoms of poisoning by copper are violent and irrepressible purgings and vomitings, followed by exhaustion and death. The best antidote is albumen, or white of egg, with which they form an insoluble and almost inert compound.

COPPER ORES.—The ores of copper are somewhat numerous and widely spread over the earth's surface. Native copper is occasionally found crystallized in cubes, octahedra, or dendritic crystals, or in amorphous masses, in North America and Siberia. Near Lake Superior is a vein of metallic copper associated with silver, two feet in thickness. The commonest ore of copper is copper pyrites, which is the ore found in Cornwall, from which more than two-thirds of the copper used in Great Britain is obtained. After being sorted and sifted, it is sent to Swansea to be smelted. North America and Saxony also supply this ore. The Australian ore, chiefly from the Burra-Burra mines of South Australia, large quantities of which are annually imported, is a mixture of the green and blue carbonate, and contains from 25 to 30 per cent. of metal, the average of Cornish pyrites containing only 8½ per cent. Certain ores found in Chili are valuable from the amount of silver they contain. The red and black oxide also occur in Cornwall, Siberia, Brazil, and Germany. *Copper pyrites* is an important ore of copper, occurring as a double sulphide of iron and copper, $Cu_2S.F_2S_3$, in various parts of the world. Copper pyrites have a brassy lustre, and are found generally in amorphous masses with a conchoidal fracture; sometimes they occur crystallized in tetrahedra. *Copper indigo* is an ore of copper found in spheroidal masses in Thuringia and near Vesuvius, in Italy. It is very nearly pure sulphuret of copper, and is of a blue colour, whence its name.

COPRIDÆ, *kop'-ri-de*, a family of four-winged insects allied to the *Scarabææ*. The name is from the Greek word for dung (*kopros*), in which these beetles are generally found.

COPROLITES, *kop'-rol-ites* (Gr., *kopros*, dung; *lithos*, stone), are the excrements of animals found in a fossil state in the secondary and tertiary strata. They consist chiefly of the voidings of saurians and sauroid fishes. The true nature of coprolites was first discovered by their occurrence near the region of the intestinal tube in the bodies of several fossil ichthyosauri. Scales, bones, teeth, and other parts of undigested food, are often found in them, and occasionally they are found exhibiting the spiral twisting noticeable in the excrement of some living fishes. Coprolites contain a considerable proportion of phosphate of lime, for which reason they are largely employed in the manufacture of artificial manures.

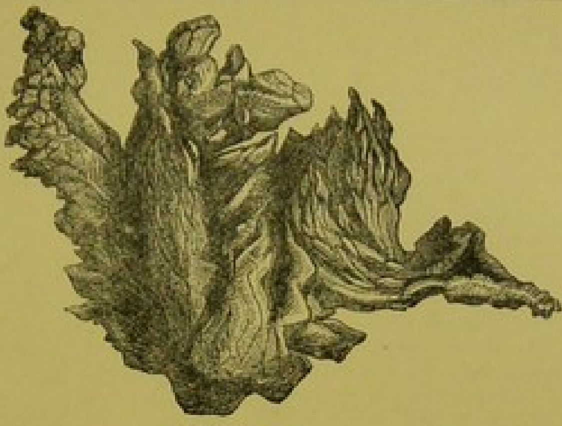
COPTIS, *kop'-tis* (from Gr., *kopto*, I cut), a genus of plants belonging to the natural order *Ranunculaceæ*. The species *C. trifoliata*, commonly called "gold thread," is a native of North America, and is much prized for its root, which is a pure and powerful bitter, and forms an excellent stomachic and tonic. The root of *C. Teeta* is found in the bazaars of India, under the names of *mishmee bitter* and *mahmira*. It is intensely bitter, and is a very valuable tonic.

COQUILLA NUTS. (*See* ATTALEIA.)

CORACOID BONES, *ko'-ra-koid*, bones connected with and strengthening the scapula in birds and reptiles.

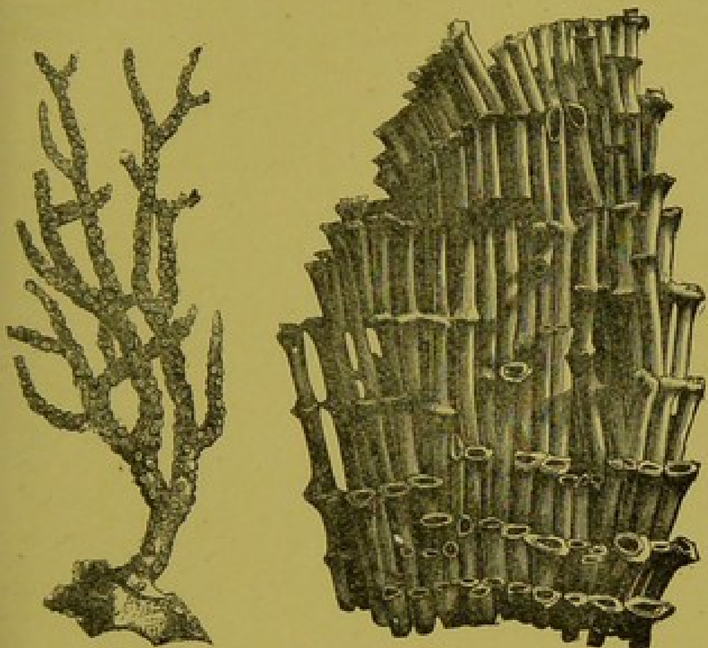
CORAL, *kor'-al* (Greek, *korallion*, maiden, or daughter, of the sea), the calcareous secretion of a jelly-like creature (sometimes known as the corallet) adapted for a sedentary mode of life, with no locomotive organs, but provided with a circle of retractile tentaculæ (slender thread-shaped organs, capable of being extended and withdrawn, and very sensitive) around the surface of the mouth, and with a central gastric cavity, or stomach, below and around which are pairs of fleshy plates extending to the sides of the polyp. Within these plates is secreted the hard matter known as coral, consisting of carbonate, and when the animal dies the soft part decays, and these external skeletons (if such a term be allowable) remain, uniting to form the masses of coral, which on examination will be found to consist of millions of starlike or radiating forms, each the secretion of one polyp. The

CONDOR.



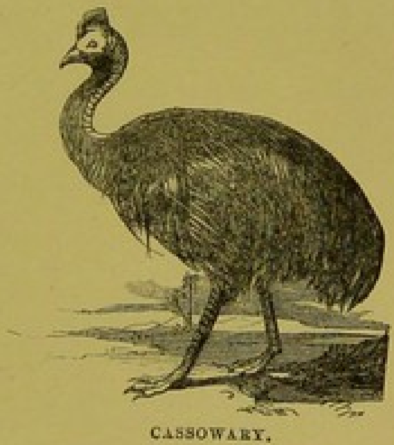
NATIVE COPPER.

CUCKOO.



FORMS OF CORAL.

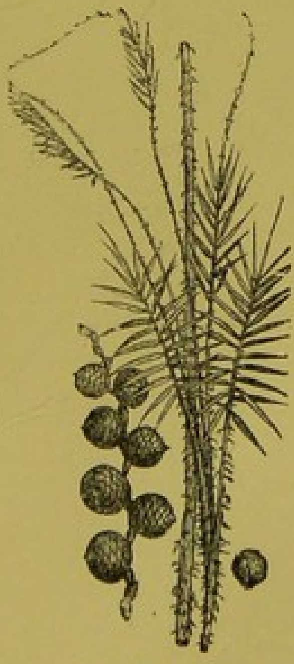
CHAMŒLEON.



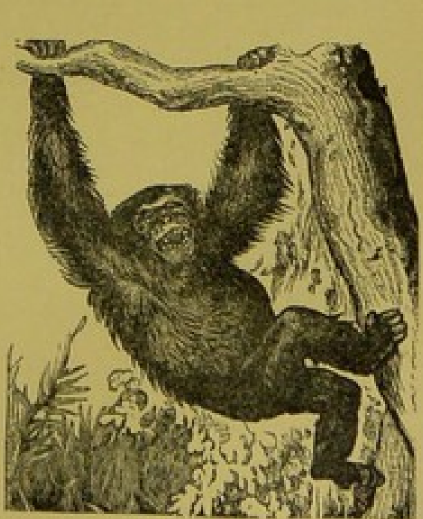
CASSOWARY.

WILD CAT.

CIVET CAT.



DRAGON PALM.



CHIMPANZEE.

coral polyp produces eggs and young, but some species multiply also through a process of budding, forming what is known as branching coral; the new product beginning as a small prominence on the side of an old coral, the mouth and tentacles soon appear, the progress of calcareous accumulation is carried on, and in time buds are seen in their turn on these new growths, and so the process is continued. The branching form of some species of coral, especially the red coral found chiefly in the Mediterranean, Red Sea, and Persian Gulf, is well known. The coral forms a considerable article of commerce, "coral fisheries" being extensively carried on, and is used in the manufacture of ornaments. Other species do not produce the branching form; but the star-shaped polyps (the *astræa*) unite, putting forth young animals in the spaces between the older ones, and maintaining a hemispherical form of the mass, which in some cases reaches the dimensions of twelve feet in diameter, accumulated by at least 100,000 of the larger corallets (or individual corals), and as many as 5,000,000 of the smaller species. The "brain coral" is a mass of this kind, exhibiting certain peculiarities, and so named from the rather fanciful resemblance the surface exhibits to the convolutions of the human brain. It is nearly spherical in shape, and traversed by ridges formed by the regularly arranged tentacles of the animals, the mouths being visible along the furrows. It is now believed that the coral polypi perform an important function in purifying the waters of the ocean, and maintaining the uniformity of its composition. Rivers are continually pouring soluble impurities into the sea, and lime salts are formed. As the fresh water alone is carried off by evaporation, there would be an injurious accumulation did not the coral polypi and marine shell fish carry off the superfluity, and so preserve the balance in this department of nature. They perform, in fact, an office analogous to that of vegetation, which keeps down the excess of carbonic acid gas in the atmosphere; and "the great ocean currents spread the water among the coral groves as the wind conveys the air through the forest."

Coral Masses and Islands.—The corallet can only live near the surface, and cannot exist if left dry. All the masses of coral, therefore, above the level of the sea, and all at a greater depth than about twenty-five or thirty fathoms, are dead coral—that is, accumulations of the calcareous secretion, the animal itself being dead. The question naturally arises, How, then, could they have been formed? As the coral cannot float, and as it is known to exist at the deepest parts at which the ocean has been sounded, some powerful cause must exist to produce such a result. The explanation is most probably afforded by the volcanic agency which we have seen to be so active and potent. There have been subsidences by which the coral formations have gradually been lowered into the sea. In some cases the living animals have continued their work on the top of the receding mass, and so maintained the level. The phenomenon of upheaval has chiefly produced the elevation of the coral mass above the surface of the sea, but the sea itself has contributed to the results by breaking off and washing together large blocks, and, by the tremendous force of the waves, throwing them in confused masses on each other. An exposed surface thus formed is rapidly increased in extent. Myriads of marine animals deposit their shells, which, as well as the coral, are ground up by the action of the waves, and fill up the interstices formed by the irregular masses, and the heat of the sun in the tropical regions splits up the more solid blocks. In time, a height is reached at which the new island is protected from the sea; and then, unless too far from any land, sea-birds rest, and their guano contributes to the formation of a fertile soil, in conjunction with the vegetable matter contributed by the driftwood, leaves, and stems washed by the ocean currents to the new shores. Seeds, especially of cocoa-nut and other palms, accumulate; smaller seeds are contributed by birds; and, in time, the coral blocks are covered with a rich soil, well wooded and grassed, and fit for the occupation of man, and having sands of dazzling whiteness, composed of powdered coral and shells on the sea-shores. Coral islands frequently exhibit a remarkable formation, and are described as Atolls (from a Malay word), or lagoon islands. (*See* Atoll.)

Coral Reefs.—In some places, reefs of coral, like those forming atolls, encircle islands of volcanic formation, at a distance of two or three miles from the shore. Instances of this formation are found in the Society Islands, including the Tahiti group, in the South Pacific, where the islands, of volcanic origin, rise in irregular conical form to a great elevation—in Tahiti to 7,000 feet—with a narrow belt of fertile ground between the mountains and the sea, and are enclosed by coral reefs, which, indeed, form large atolls, with islands in the centre. There are openings in the reefs giving access to the islands. Two islands of the group, Raiatea and Tahaa, are enclosed within one reef, of an irregular oval shape. *Barrier reefs* are walls of coral, extending in straight lines in front of the shores of continents or large islands, not encircling the latter, as in the instances above mentioned, and generally at a greater distance from the coast. There is such a reef, 400 miles long, off the coast of New Caledonia, in the South Pacific; but the most extensive formation of the kind is the Great Barrier reef, a narrow ridge, and extending for 1,100 miles from lat. 9° 15′ S. to lat. 24° 36′ S., generally parallel to the east coast of Australia, but varying in distance from the shore from twenty to seventy miles. There are, however, openings by which vessels enter the interior ocean, and reach the ports on the eastern side of Australia. *Fringe reefs* is the name given to narrow belts of coral immediately adjoining the coast, with no intervening lagoons.

CORAL RAG, in Geology, a group of the Middle, or Oxford oolite, consisting of beds of petrified coral, interstratified with oolitic limestone. They occur in Berkshire, Wiltshire, and Yorkshire, and are in some places more than 180 feet in thickness.

CORAL TREE, or CORAL FLOWER, a genus (*Erythrina*) of trees and shrubs of the natural order *Leguminosæ*, sub-order *Papilionaceæ*, natives chiefly of tropical and sub-tropical regions. The flowers form long spikes of a rich crimson or scarlet colour, resembling coral. An Indian species, *C. Indica*, has the stem covered with thorns, and is used for hedges, and the wood being light and spongy is used to make substitutes for corks. A Brazilian species, *E. crista galli*, is cultivated in this country in green-houses. A plant of a very different kind, belonging to the order *Euphorbiaceæ*, is sometimes named the Coral Tree.

CORALLINE, Algæ of the sub-order *Ceremiaceæ*, remarkable as being covered with a calcareous incrustation. The common coralline, a beautiful object with branching filaments is very abundant in the rock pools on the British coasts. In tropical seas, the corallines are seen in the greatest perfection. Various small zoophytes, found on the British coast, are popularly known as corallines.

CORCHORUS, *kor′-kor-us* (from Gr., *koreo*, I purge), a genus of plants belonging to the natural order *Tiliaceæ*. The most important species is *C. capsularis*, the jute-plant, a native of India. The fibre called *jute*, or *jute-hemp*, is obtained from the bark. (*See* Jute.) The species *C. olitorius*, commonly called Jews' mallow, is used in some parts of the world as a pot-herb.

In Panama, the leaves of *C. mompoxensis* are employed as a substitute for Chinese tea.

CORDYCEPS, *kor'-di-seps*, a genus of Fungi, including many species which are very destructive to living plants and animals. The disease called ergot, which occurs in the grains of rye and other grasses, is produced by *C. purpurea*. (*See* SECALE.) Caterpillars are frequently killed by other species growing in them. The remains of the caterpillar, with the developed fungus of the species *C. Sinensis*, is a highly esteemed drug in China, where it is much used as a tonic.

CORNACEÆ, *kor-nai'-se-e*, the cornel or dogwood family, a natural order of dicotyledonous plants of the sub-class *Calyciflorœ*. They are trees, shrubs, or rarely herbs. There are nine genera and forty species natives of the temperate parts of Europe, Asia, and America. They are chiefly remarkable for tonic, febrifugal, and astringent properties. (*See* CORNUS.)

CORN-CRAKE. (*See* LANDRAIL.)

CORNEA, *kor'-ne-a* (Lat., *cornu*, a horn), one of the coats of the eye, from its being of a horny consistence.

CORNEL, OR CORNELIAN CHERRY, *kor'-nel*, a tree or shrub of the natural order *Cornaceœ*. It is a native of middle and southern Europe and of the greater part of Asia, and in Germany and other places is cultivated as a fruit tree. It stands nearly twenty feet high, has oval leaves and small heads of flowers, which abound in honey. The fruit is oblong, about the size of a small cherry, and generally of a shining red colour, but sometimes yellow or white. The wood of the tree is very hard and tough, and is much used for making mathematical instruments. The dwarf cornel (*C. Suecica*) is a small plant found in mountain pastures and bogs. The sweet red fruit is tonic, and so increases the appetite, that the plant has a Gaelic name, signifying the "plant of gluttony."

CORNS, *korns* (Ang.-Sax.), small, hard, troublesome excrescences on the feet, arising from a thickening of the cuticle or epidermis, and owing generally to irritation, caused by excessive pressure or friction on the part. Corns are of two kinds—hard and soft, the latter being situated between the toes. Frequently a bursa, or bag, is formed beneath the corn, which is apt to inflame and cause great pain and irritation. Every person troubled with corns must have noticed that they are most painful in wet weather. In the treatment of corns, the great object is to remove all undue pressure or friction; and for that purpose, the boots or shoes should be easy and pliant. This will be still further effected by protecting the corn with a small piece of thick soft leather, spread with diachylon or other emollient plaster, and having a hole in the centre corresponding with the size of the corn. The feet should also be frequently bathed with warm water, and as much as possible of the corn carefully picked away. The practice of paring corns with a knife is dangerous, and although it may afford temporary relief, rather encourages the growth of the corn. If the corn is very sensitive, it ought to be occasionally touched with lunar caustic; and if much inflamed, a warm bread poultice should be applied to it. Horses suffer much from corns, which are very painful and often cause lameness. They require careful treatment on the part of the groom, or, in severe cases, of the veterinary surgeon.

COROLLA, *ko-rol'-la* (Lat., a little crown), the inner envelope of the flower, consisting of leafy organs called *petals*, and situated in a complete flower, between the calyx and the stamens. It is generally the most conspicuous whorl of organs, being more or less coloured. It is, in fact, that part of the plant which usually delights us most by its gay appearance and fragrance. Petals are rarely green, though occasionally this colour is met with. When there is but one whorl of enveloping organs in the flower, it is regarded as the calyx (which *see*), and the flower is said to be *apetaloid*. A petal is often narrowed below into a stalk-like portion analogous to the petiole of a leaf, as in the wallflower; the narrowed portion is then termed the *unguis* or *claw*, and the expanded portion the *limb*. Such a petal is said to be *unguiculate* or *clawed*. The shapes of petals are indicated in botanical descriptions by terms easily understood; such as *oblong*, *lanceolate*, *elliptic*, *orbicular*, *ovate*, and *cordate*, applied to the outlines, and *concave*, *tubular*, and *boat-shaped*, applied to the forms of petals which are not flat. In describing their direction, the terms *erect*, *connivent*, *divergent* and *reflexed*, are used in the same sense as when applied to the parts of the calyx. When the petals are all of the same size and form, the corolla is termed *regular*; when they vary in these particulars, it is said to be *irregular*. In some flowers the corolla has an appendage known as the *corona*, or crown, sometimes appearing like an interior corolla, and sometimes assuming very peculiar forms.

COROLLIFLORÆ, *ko-rol-le-flor'-e*, a sub-class of *Dicotyledones*, comprising those plants which have flowers furnished with both calyx and corolla, the latter being composed of united petals; the stamens are inserted on the corolla or ovary, or free and arising from the thalamus.

CORONELLA, *ko-ro-nel'-la*, a genus of serpents of small size, belonging to the family *Colubridœ*. They inhabit the warm and temperate parts of the world, and are non-venomous.

CORPULENCE, *kor'-pu-lens*, (Lat., *corpulentia*, from *corpus*, the body), is an undue bulkiness or size of the body, arising from an excessive accumulation of fat in certain parts. It most commonly takes place after the age of forty, but is not confined to any particular period of life, being found also in childhood and youth. The causes of corpulence are both natural and acquired. There are some persons who have a natural tendency to corpulence; in others it may be induced by modes of life, indolent and sedentary habits, and the use of certain kinds of food. The undue accumulation of fat produces a variety of effects, interfering with the vital energies of the body, and incapacitating for exertion. The chances of life are not so great among persons of a corpulent habit as among those of a normal condition. All sudden or violent measures to get rid of corpulence are attended with harm; and not the least dangerous is the popular remedy of vinegar, which has the effect of destroying the digestive powers. Attention to diet, and the avoidance of such articles as tend to generate fat, together with active exercise and the counteracting of indolent habits, are among the best means that can be employed. There are numerous very remarkable cases of corpulence on record. Among modern instances known in this country, was Bright of Maldon, in Essex, who died on the 12th of November, 1750, in the twenty-ninth year of his age. He weighed 616 lbs; and it is said that seven persons of ordinary size could be inclosed in his waistcoat. Daniel Lambert, who is supposed to have been the heaviest man that ever lived, died at Stamford, in Lincolnshire, at the age of forty, on the 21st June, 1809. He is said to have weighed 52 stones 12 lbs., or 740 lbs.

CORPUS, *kor'-pus*, (Lat., body), is a term applied to certain parts of the animal structure; as the *corpus callosum*, the *corpora quadrigemina*.

CORPUSCLES, *korp'-us-kls*. (*See* Blood.)

CORRELATION OF THE PHYSICAL FORCES, *kor-rel-lai'-shun* (Lat., *con*, with; *relatio*, a throwing back), the reciprocal relation between gravitation, the molecular forces, heat and light, electricity, and animal force. (*See* Force.)

CORSAC, *kor'-sak*, an animal of the dog family, found in the deserts of Tartary and India. It is about the size of a fox, which it resembles in the head, tail, and colour; but it is not nocturnal in its habits, and lives in burrows in large communities.

CORUNDUM, *kor-un'-dum*, a mineral containing pure alumina, and occurring in hexagonal prisms of great hardness. When coloured and transparent, corundum constitutes *sapphire*, and the granular variety is known as *emery*.

CORVIDÆ, *kor'-vi-de*, a family of birds of the order *Insessores*, and including ravens, crows, jackdaws, rooks, magpies, jays, and choughs.

CORVUS. (*See* Crow.)

CORYLACEÆ, or CUPULIFERÆ, *kor-il-ai'-se-e* (Gr., *korus*, a helmet, the calyx enwrapping the fruit), in the Oak family, a natural order of dicotyledonous plants, in the sub-class *Monochlamydeæ*. The plants of this order abound in the forests of temperate regions, and a few occur in the high lands of tropical climates. They are of great importance as timber-trees: many yield edible seeds, and some have astringent barks and cupules. There are about 280 known species, which have been arranged into 10 genera, the most noteworthy being *Quercus* (the oak), *Corylus* (the hazel), *Fagus* (the beech), *Castanea* (the chestnut), and *Carpinus* (the hornbeam).

CORYLUS, *kor'-e-lus*, the typical genus of the natural order *Corylaceæ*, including the common hazel (*C. avellana*). (*See* Hazel.)

CORYMB, *kor'-imb* (Lat., *corymbus*), the name given to a particular form of inflorescence. It is a kind of raceme (which *see*), in which the peduncles (flower-stalks) become gradually shorter as they approach the top, so that all the flowers are about on a level. It occurs in some species of *Cerasus*, in the hawthorn, and many familiar plants. When the stalks or secondary axes of a corymb, instead of bearing flowers immediately, divide and form tertiary axes, a *compound corymb* is produced, as in some species of *Pyrus*.

CORYMBIFERÆ, *kor-im-bif'-ere* (Lat., *corymbus*, and *fero*, I bear), a sub-order of the *Compositæ*, consisting of plants having florets all tubular and perfect, or having tubular and perfect florets in disk, and tubular and pistilliferous, or ligulate, florets in the ray. The genus *Chrysanthemum* may be taken as an example. Two species of this genus grow wild in Britain; namely *C. leucanthemum* (the ox-eye) and *C. segetum* (the corn marigold). In our gardens a number of beautiful varieties of the species *C. indicum*, *sinense*, and others are cultivated. They are hardy plants, and are remarkable for the number and the varied colours of their flowers, which appear late in the autumn. Fine displays of Chrysanthemums are made in the parks and ornamental gardens of London.

CORYPHA, *kor-i'-fa* (Gr., *koruphe*, the summit, the leaves growing only on the top), a genus of palms. It includes one remarkable species, namely *C. umbraculifera*, the talipot palm of Ceylon, from which large quantities of sago are obtained.

CORYPHENE, *ko'-re-fene*, a genus of fishes of the family *Scomberidæ*, commonly called dolphins. (*See* Dolphin.) They are found in the seas of warm climates, and some species are seen in the Mediterranean. The largest (*C. hippuris*) is about five feet long. They move with great rapidity, and will leap out of the water twenty or thirty feet. The colours are very brilliant, and change rapidly when the fish is dying. The body is long and compressed, covered with small scales, and the head rises in a sharp crest.

CO-SINE. (*See* Trigonometry.)

COSMOGONY, *kos-mog'-o-ne* (Gr., *kosmos*, the universe; *gone*, generation), the science which relates to the formation of the universe, as distinguished from *cosmography*, which treats of the universe as we see it, and from *cosmology*, which treats of the actual and permanent state of the earth as it is. Cosmography has been embodied as a science by Baron Humboldt, in his celebrated work entitled "Cosmos." All cosmogonists may be divided into two great classes—those who believe that the world sprang into existence at the order of the Almighty, and those who hold that the universe is in itself the body and being of Deity, and, as such, has been in existence through all eternity. The former are termed Theistical cosmogonists, and the latter Pantheistical.

COSMOS. (*See* Cosmogony.)

COSSUS, *kos'-sus*, a genus of night-flying moths. (*See* Goatmoth.)

COSTMARY, *kost'-ma-re*, the *Balsamita vulgaris*, formerly known, as "the plant of the Virgin Mary," or "ale cost," a perennial plant of the natural order *Compositæ*, sub-order *Corymbiferæ*. It is a native of the south of Europe and is cultivated for the sake of the fragrant leaves. It stands nearly three feet high, and has yellow flowers. The leaves were formerly put into ale and negus, and in France are used in salads.

COTIRGA, *ko-tir'-ga*, a genus of birds (*Ampelis*) of the family of the Chatterers, natives of South America. The males are remarkable for the beauty of their plumage, mostly azure and purple, in the breeding season; but at other times they are of a grey or brown colour.

COTONEASTER, *kot'-on-ees'-ter*, a genus of plants, of the natural order *Rosaceæ*, sub-order

Pomaceæ. They are shrubs or small trees, some evergreen. The fruit is small and of disagreeable flavour, but of bright colour, and as it remains on the tree in winter makes it ornamental. Most of the species are natives of mountainous regions especially in Asia; but they thrive in this country and are cultivated as ornamental shrubs.

COTTON, *kot'-ton* (probably from Arabic *kotun*, fine), one of the most important of all vegetable fibres—commercially, perhaps, the most important—the produce of plants of the genus *Gossypium*, of the natural order *Malvaceæ*, or mallow family. They are partly shrubs and partly herbaceous, and either perennial or annual, are natives of the tropical parts of America, Africa, and Asia, but are cultivated in the temperate zones. Several species furnish cotton, which consists of hairs covering the seeds. These hairs upon the seeds, and the occurrence of three leafy bracts, united at their base outside the flower, constitute the distinctive characters of the genus. There appear to be four distinct species from which our commercial cotton is derived. Many other so-called species have been described, but they are probably mere varieties. The first cotton fabrics were manufactured from the hairs of the species *G. herbaceum*, or *Indicum*, the common cotton-plant of India, cultivated also in China, Egypt, and other places. The stems are less woody than in other species; hence its specific name, which signifies herbaceous. It is a pretty plant, and rises from eighteen inches to two feet in height during the first year of growth. It is usually cut down annually; but if allowed to grow, it will attain a height of five or six feet, and its branches will become rather woody. All the younger parts of the stem are covered with short hairs, and marked with black spots. The flowers are bright yellow, each petal being marked with a purple spot near the base. The flower is succeeded by a fruit, which gradually becomes dry, and then bursts into three or four valves, when the cotton-wool is seen issuing from it in all directions. This is the Surat cotton of commerce. The cotton is generally white; but much of that produced in China is of the yellow or tawny colour, peculiar to the fabric called "Nankeen." *G. arboreum*, the tree-cotton, is another Indian and Chinese species, but, unlike the last, it assumes the aspect and dimensions of a small tree, from fifteen to twenty feet in height. The flowers are of a bright red colour. The cotton hairs are remarkably soft and silky, and are woven by the natives into a very fine muslin used for turbans by the privileged religious classes only. *G. Barbadense* is the species which yields all the best cotton. It is called the Barbadoes, or Bourbon cotton, but does not appear to have been originally a native of the New World. It is a perennial plant, and has a shrubby stem, from six to fifteen feet in height. The flowers are yellow, like those of *G. herbaceum*, and have a dark spot at the base of each petal. The fruit is capsular, and contains in its interior from eight to twelve black seeds, which, on being freed from the cotton-wool, are found to be destitute of down, unlike those of the preceding species, which are covered with firmly-adhering short hairs. The plant was introduced into Georgia from the Bahama Islands, where it had been grown from seed obtained in the West Indies. In the small American islands which fringe the coast of Georgia from Charlestown to Savannah, this plant has produced the celebrated Sea Island cotton, which is unrivalled for the length of its staple, its strength, and its silkiness. This cotton, when cultivated in the cooler and drier climates of the hill country of Georgia, is inferior in quality, and shorter in staple. This fact shows how great is the influence of external circumstances on the growth of the cotton-plant. The species *G. Peruvianum* is supposed to be indigenous to America. Like the Bourbon cotton, it has black seeds and yellow flowers. The seeds adhere together, however, in a peculiar way, forming a kidney-shaped mass. This plant furnishes the South American varieties of cotton; as Pernambuco, Peruvian, Maranham, and Brazilian. After the Sea Island and Egyptian, these South American cottons obtain the highest price in the market. Cotton is now extensively cultivated in South Africa (Natal), in the West Indies, and in Queensland (Australia). The seeds of the cotton-plants, after the cotton has been separated from them, on being submitted to pressure, yield a fixed oil, which may be used for burning in lamps. If examined under the microscope, the cotton hair will be found apparently to consist of two delicate transparent tubes, the one twisted round the other. If, however, the hair be examined in its young state, it will be found to be an untwisted cylindrical tube. Its changed appearance when it reaches to maturity can be accounted for by the circumstances under which it is developed. As the seeds and hairs grow, the capsules do not appear to expand with equal rapidity; and, consequently, the hair is exposed to pressure on all sides. The result of this is, that the hair collapses in the middle, leaving a half-formed tube on each side. These uncollapsed portions of the hair give it the appearance of a flat ribbon, with a hem or border at each edge. The hair does not, however, grow out straight, but, coming in contact with other hairs and the sides of the capsular fruit, it becomes twisted. This twisting is undoubtedly the great fact that makes the cotton hair of value. The twisting gives the power of uniting and forming a cord strong enough to be woven.

COTTON GRASS, a genus of plants (*Eriophorum*), of the natural order *Cyperaceæ*, generally natives of the colder northern regions, some of the species being found in Britain. The fruit has long silky hairs, which is sometimes used for candle-wicks and common stuffing. The fibre of an Indian species is strong, and is used for cordage and twisted into cables. The leaves of cotton grass were at one time in repute as a remedy for diarrhœa, and the pith of the stem for tape-worms.

COTTONWOOD. (*See* POPLAR.)

COTTUS, *kot'-tus* (Gr., *kotta*, a head), the name of a genus of spiny-finned fishes, characterized by the large size of the head; whence their name. Some of the species are marine, others inhabit fresh water. There are two species of this genus to be found in British seas—the sea scorpion (*Cottus scorpio*), and the Father-lasher (*Cottus bubalis*).

COTURNIX, *ko-tur'-nix*. (*See* QUAIL.)

COTYLEDON, *ko-til-e'-don* (Gr., *kotule*, a cavity, in allusion to the cup-like leaves), a rudimentary leaf, forming part of the embryo of a flower plant. (*See* EMBRYO.)

COTYLEDON, the Navelwort, a genus of plants belonging to the natural order *Crassulaceæ*.

The species *C. umbilicus* is a common plant on walls and rocks in the West of England. It has long been in use as a popular remedy in hysteria, and as an external application to destroy corns and warts, and is employed as a remedy for epilepsy.

COUCAL (Egyptian), *koo'-kal* (*Centropus ægyptus*), a bird about 15 inches long. The feathers of the head and neck are of a metallic greenish hue, which colour, passing to a duller tint, marks the bird's upper parts generally, while the under portions are white. It is solitary in its habits, breeding in holes in trees, and feeding on insects and small reptiles. Its note somewhat resembles that of our cuckoo; indeed, the Arabs call the bird *hou-hou*, from its repetition of these syllables.

COUCH-GRASS, *kowtch*, known also as wheat, or dog-grass, quitens and squitch, or quitch, a weed, which botanicaly is of the same genus as wheat. In some parts of Italy, the roots are used for feeding horses, and in times of scarcity, have been ground into meal to make bread. A kind of beer is made from them, and they are used as an aperient medicine.

COUCHING. (*See* EYE, DISEASES OF THE.)

COUGH, *kof*, a spasmodic action of the respiratory organs, occasioning a violent and sonorous expulsion of air from the lungs. Coughing most frequently occurs as a symptom of some other complaint, as catarrh, pleurisy, phthisis, &c.; and hence some nosologists have been led to regard it as always so. At times, however, it is as truly idiopathic as any other disease. It is of the utmost importance that the air-passages to the lungs should be perfectly free from any obstruction; and hence the larynx, trachea, and bronchi are endowed with a very high degree of irritability, so that the slightest contact of a foreign body causes the most violent excitement. Coughing, then, is occasioned by an irritant in these parts, and is an attempt to get rid of the irritation. The air from the lungs is suddenly driven up with great force through the air-passages, so as to carry with it any causes of irritation that may be present in them. Cough may also be excited by irritant vapours or gases, or may arise from an abnormal sensibility of the lining membrane. In most cases cough is attended with expectoration, but sometimes it is quite dry. When the mucous membrane of the air-passages is unduly stimulated, the vessels become overloaded with mucus, and coughing is produced to effect its discharge, as is frequently observed in catarrh. This kind of cough is often a chronic disease in old age, and is frequently very troublesome. The dry cough which is mostly unattended by any expectoration, is obviously of a nervous character, and is observed in highly irritable, nervous, and hysterical constitutions. The treatment of cough, when symptomatic of any other disease, will be found noticed in other parts of this work; as CATARRH, BRONCHITIS, PHTHISIS. Coughs should never be neglected; for they are frequently symptomatic of organic disease, or may induce it. If they do not yield to simple remedies, medical advice ought to be sought.

COW, *kow*, the female of the bovine species.

COW BUNTING (*Molothrus pecoris*), known also as the cowpen bird, cow-blackbird, and by other similar names, a passerine bird of North America; like the cuckoo, it deposits its eggs in strange nests. It is about the size of the thrush, and is chiefly black, with a violet tinge. The tail is slightly forked; legs and claws glossy black, and very muscular.

COW PARSNIP, a genus of plants (*Heracleum*) of the natural order *Umbelliferæ*. In this country it is known as hog-weed, a coarse rank weed, with hairy leaves, and about four feet high. It is used occasionally as food for cattle and for fattening hogs.

COW PLANT (*Gymnema lactiferum*), a perennial plant of the natural order *Asclepiadaceæ*, a native of Ceylon. The name is derived from the milky appearance of the juice.

COW-POX. (*See* VACCINATION.)

COW TREE, a popular name for several species of trees, natives of tropical countries, which yield a juice sometimes used instead of milk. Some are allied to the fig, some to the bread-nut. The best known are the Hya-hya and the Palo de Vaca, both natives of equatorial America.

COWAGE, OR COWITCH, short, brittle hairs which grow on the pods of plants of the genus *Mucuna*, natural order *Leguminosæ*, natives of the tropical parts of America and Asia. They are used in medicine, being administered in syrup or honey for the purpose of killing and expelling intestinal worms. The pods of the unripe plants are sometimes boiled and eaten, and are said to be of agreeable flavour.

COWBARE. (*See* HEMLOCK.)

COWBERRY. (*See* WHORTLEBERRY.)

COWRY, *kow'-re*, a genus of gasteropodous molluscs, the type of the family *Cypræidæ*. The shells, sometimes known as "porcelain shells," are remarkable for the brilliancy of their colours, and the high polish of which they are susceptible. They abound both in the old and new world, but their greatest development, both in point of size and number of species, takes place in warm climates.

COWSLIP (*primula veris*), a pretty little flower, found abundantly in pastures in England and in most parts of Europe. The flowers, fermented with sugar, make a kind of wine, in much favour in rural places.

COW WHEAT (*melampyrum*), a genus of plants of the natural order *scrophulasiaceæ*, natives of the northern temperate regions. They are annuals, growing in cornfields and pastures, and are supposed to be fattening to cattle, and to improve the butter made from the milk of cows feeding on it.

COYPU, *koi'-pu* (*Myopotamus Copyus*), a rodent animal, smaller than the beaver, but with many similar characteristics. Its habits are aquatic; it burrows near the margin of rivers, and swims with the greatest ease. Its hind feet are webbed; its head large and depressed: ears small and rounded; muzzle long and pointed, and ornamented with bristle-like whiskers. Its tail is round and slender, instead of being flattened like the beaver's. It is peculiar to South America, and its skin forms the staple of a considerable trade, the fur being known as racoonda and putria.

CRAB, *krab* (Sax., *crabba*).—This name is popularly applied to the whole of the crustaceans belonging to the order *Decapoda*, which is divided into three sub-orders—the *Macroura*, or *long-tailed crustacea*, to which the lobster and crayfish belong; the *Anomoura* which appears to hold an intermediate position between the former and the third sub-order—the *Brachyoura*. To the latter the common crab belongs. This animal is thus characterized:—The abdomen is always converted into a short jointed tail, quite destitute of terminal appendages, and bent round so as to fold closely under the breast. The cephalo-thorax is usually of a more or less rounded form, generally broader than long, and often produced in front into a point. The upper surface is entirely covered by a single plate (the carapace, or back). The eyes and the inner antennæ, the latter of which are very short, can be entirely concealed within small cavities of the forehead. The outer antennæ are never of any great length, and the anterior feet are always converted into nippers. The four other pairs of legs are generally terminated only by single claws. The feet of the crab, although sometimes flattened, which assists the animal greatly in making progress through the water, are, as a rule, essentially made for pedestrianism. Its walk or run is of a very curious nature; and when alarmed it shuffles along sideways, but with great rapidity. In some species of the *Brachyoura* the young crabs undergo several metamorphoses before arriving at maturity; but in many others immediately they are hatched they resemble their parents in all but size. The common crab *(Cancer Pogurus)* inhabits deep water, and is caught either on the rocks at low tides, or by means of a trap—a basket—baited with meat or some animal garbage, into which the animal is easily enabled to crawl, but out of which the intellects of the crab are too dull to devise a means of escape. The small edible crab *(Cancer mœnas)* is also very common on all parts of our coast, but not so much valued as the former. A very curious species is the hermit-crab, belonging to the sub-order *Anomoura*. This creature possessing a very soft abdomen, it would be very likely to be seized by some predacious fish, if it were exposed. To prevent this, the hermit-crab seeks for some empty tenement, wherein it may take up its abode. The habitation usually chosen is the shell of some univalve mollusk.

CRACIDÆ, *kra'-si-de* (Gr., *kraxo*, to vociferate), a family of large gallinaceous birds, natives of America. (*See* CURASSOW.)

CRAG, in Geology, several groups of strata, containing masses of shelly sand.

CRAKE, a genus of birds (*Crex*) of the family *Rallidæ*, with shorter heads and thicker bills than the true rails. The common corncrake or land rail (*C. pratensis*) is well-known in all parts of England, where, however, it is only seen in summer, being a bird of passage. The name is taken from the peculiar call-note of the male. It weighs rather less than half-a-pound, and is a delicacy for the table.

CRAMBE, *kramb* (Gr.), a genus of plants belonging to the natural order *Cruciferæ*. The species *C. maritima*, or sea-kale, grows wild on the sandy sea-shores of Britain. About the middle of the last century it was first introduced into gardens and grown like asparagus, under a covering which shielded it from the action of light. So cultivated, the stem and leaf-stalks form a delicious vegetable which is preferred by many to asparagus.

CRAMP, *kramp* (Sax., *kramma*; Du., *kramp*), is an involuntary and painful contraction of one or several of the voluntary muscles connected with a certain part or organ, as of the leg, foot, or arm. It is often the result of cold, particularly when it attacks bathers; is sometimes occasioned by a greatly disordered state of the bowels, and frequently comes on without any obvious cause. In general, cramp is readily removed by a forcible exertion of the antagonist muscles, so as to overcome the spasmodic contraction, or by friction and warmth. Cramp of the stomach is to be combated by the external and internal use of stimulants, and antispasmodics. (*See* SPASM.)

CRANBERRY. (*See* OXYCOCCUS.)

CRANE, a genus of birds belonging to the order *Grallatores*, and the type of the family *Gruidæ*. Cranes are found in considerable flocks in the northern parts of Europe. The bird, which differs chiefly in the position of the toes from the heron, measures about five feet in length; general plumage ash-coloured, but forehead black; sides of the head and hind part of the neck white. On the upper part of the neck there is a bare ash-coloured space of about two inches, and above this the skin is naked and red, with a few coloured hairs. The pinion of each wing is furnished with an elegant tuft of curled feathers. The bill is long, straight, and compressed, obtuse towards the end, and with the lateral base deeply channelled. Its nest is usually constructed in some swampy tract or insulated ruin. It lays two eggs, of a pale dull-greenish colour, blotched with brown. Its food is frogs, snails, grain, vegetables, &c. When a flock congregated on a marsh compose themselves for slumber, some few are invariably wide awake, and stand perched on one leg, looking out for danger. The crane is a bird delighting in the wastes that lie on the edges of marshes, or that are subject to periodical overflowings by rivers. The common crane (*Gras cinerea*) breeds in the northern parts of Europe and Asia, and in the winter seeks the warmest of tropical regions. Once very abundant in England, it is now very rarely seen there. It feeds on roots and seeds, as well as on reptiles and worms. The flesh is considered a delicacy. The Demoiselle or Numidean crane (*Arithropoides virgo*) is a native of Africa. It is, although smaller than the common crane, of much more graceful build and handsome plumage. The chief peculiarities are a tuft of snowy feathers, which pass off backwards from behind each eye, and the long pointed feathers which hang loosely from the upper part of the breast. Its chief colours are silver-grey and black. The crowned crane (*Ardea pavoniara*) is somewhat smaller than the last-mentioned, and is chiefly known by the possession of a close tuft of velvety black feathers covering the forepart of the head, while behind them rises a remarkable crest of fine feathers twisted spirally, and fringed along its edges with a series of black pointed hairs. Its cheeks and temples are entirely naked, and covered with a bright rosy red. The whooping crane of America is a large bird.

CRANE-FLY, a genus of two-winged insects (*Tipula*), nearly allied to the gnat family. They are of large size, with very long legs, and spreading wings. One species (*T. oleracea*, the "Daddy longlegs," of children) abound in summer, and the larvæ, are extremely destructive to crops.

CRANIUM. (*See* SKULL.)

CRASSULACEÆ, *kras-su-lai'-se-e* (Lat., *crassus*, thick, from the thickness of its leaves), the Houseleek or Stonecrop family, a natural order of dicotyledonous plants in the sub-class *Calyciflorœ*—succulent herbs or shrubs with exstipulate leaves. The flowers are perfectly symmetrical, the sepals, petals, and carpels being equal in number (from three to twenty), and the stamens being also equal to them, or twice as many. The *Crassulaceæ* are found in very dry situations in all parts of the world; a large number occur at the Cape of Good Hope. Astringent, refrigerant, and acrid properties characterize them, and have given a few some importance as medicinal plants.

CRATÆGUS, *krat-e'-gus*, a genus of plants belonging to the natural order *Rosaceæ*. The species *C. oxyacantha* is the Hawthorn, Whitethorn, or May, so well known for the beauty and fragrance of its flowers, and for being the best hedge-plant in Europe. It is the only species indigenous to Britain. The azarole and the aronia, natives of the south of Europe and the Levant, bear edible fruit, about the size of a crab-apple. Some varieties of this species are highly ornamental, producing double pink or scarlet blossoms.

CRATER, *krai'-ter* (Gr., *krater*, a cup or bowl), the mouth or orifice of a volcano, so named from its cup or bowl shape. (*See* VOLCANO.)

CRAYFISH, OR CRAWFISH, *krai'-fish* (*Astacus fluviatilis*), a crustaceous animal, differing little in general appearance from the lobster. It belongs to the order *Decapoda*, sub-order *Macroura*. Species of this genus are found in almost all parts of the world. The flesh is reckoned cooling and nutritious. It lives best in rivers, where it takes up its habitation beneath stones and in holes in the banks, there lying in wait for the larvæ of insects, decomposing animal substances, and small fish.

CREASOTE, *kre'-a-sote* (Gr., *kreas*, flesh; *sozo*, I preserve), a fluid containing oxygen, hydrogen, and carbon, first found by Reichenbach, in the heavy oil obtained by the distillation of wood-tar. When pure, it is a colourless oily liquid of high refractive power, boiling at 398°. It is not easily kindled, but, when burnt, it gives forth a sooty smoky flame. It has a burning taste, and its odour is peculiar. From its great power of coagulating albumen, it is employed as a cure for toothache, a drop placed on the exposed nerve destroying its vitality. It is sparingly soluble in water, to which it gives its odour and taste. It is freely soluble in acetic acid, alcohol, ether, benzol, and tersulphide of carbon. It coagulates albumen immediately, and is the most powerful antiseptic known. Meat that has been plunged into a solution containing only 1 per cent. of this substance becomes dry and hard on exposure to the air, and does not become putrid.

CREATINE, OR KREATINE, *kre-a-teen'* (from Gr., *kreas*, flesh), an organic base obtained from the juice of flesh. Strong acids convert it into *Creatinine*, by the abstraction of the elements of water. Creatinine is one of the normal constituents of urine.

CREEPER, *kreep'-er* (*Certhia*).—With the exception of the yellow-crested wren, the common creeper (*Certhia familiaris*) is probably the smallest-bodied British bird: when fully grown its weight is only five drams. The bill is hooked, the legs slender, and the toes and claws very long. The nest of the common creeper is built in a hole in the bark of a tree, and is formed externally of hay and lined with feathers. It is a constant resident in Britain, but, owing to its bustling habit and swift movements, is seldom seen even in localities where it abounds. The wall-creeper (*Certhia muraria*), is a more rare bird in every other part of Europe save the south. Its colour is of a deep bluish-grey; the wing-coverts and middle quill-feathers black, those nearest the body edged with white. This bird clings to the vertical faces of walls and rocks, just as the common creeper attaches itself to the perpendicular surface of trees.

CRENIC ACID, *kre'-nik*, produced by decaying vegetation, especially in marshes and peat-bogs.

CRESS, a general name for many plants, the leaves of which have a pungent flavour, adapting them for salads, mostly belonging to the genus *Lepidium*, natural order *Cruciferæ*. The common Cress (*L. Sativum*) is well known as a salad ingredient, easily grown, even in winter, and generally combined with mustard. There are many other varieties of cress both in Europe and America, none of them, however, so familiar as the water-cress (*Nasturtium officinale*), one of the most wholesome of spring vegetables. It grows best in clear running water, and is extensively cultivated.

CRESCENTIACEÆ, *kres-sen-te-ai'-se-e*, the *Crescentia* or Calabash-tree family, a natural order of dicotyledonous plants in the sub-class *Corolliflorœ*. The order includes about 34 species, which have been arranged in 11 genera. They are natives exclusively of tropical regions. The sub-acid pulp, the fruit of *Crescentia Cujete*, the calabash-tree, is eaten by the negroes in Jamaica, and the hard shell is used for holding liquor or snuff, and for many other purposes. The fruit of *Parmentiara edulis*, another plant of this order, is eaten by the Mexicans, and that of *P. cerifera* is greedily devoured by cattle in Panama. The latter fruit resembles a candle in shape, and the plant is commonly called the candle-tree.

CRETACEOUS SYSTEM, *kre-tai'-she-us* (Lat., *creta*, chalk), in Geology, the name given to the last or uppermost of the secondary formations. (*See* GEOLOGY.) The life of the whole cretaceous period was abundant, as the known fossils within the British area represent land plants, fresh-water, and marine shells and fish, large terrestrial and marine reptiles, and species of every class of animal having hard parts capable of preservation, except birds and mammals; and even as regards these, most geologists believe their absence to be accidental, as both existed during the preceding period, though their fossil remains are very rare. The more important useful products of this system are chalk, flint, fuller's earth, phosphatic nodules, and the so-called "firestone rock." The two latter are extensively employed as manures.

CRETINISM, *kre'-tin-izm*, idiocy arising from imperfect formation or development of the brain, and generally accompanied with great bodily deformity. The name is of uncertain origin. Some derive it from *Chrétien* (Fr., a Christian), because they were generally regarded as beings incapable of sinning, and thus were viewed with some kind of respect. According to others, it is from the Romance of Grison *cretina*, a corruption of the Latin *creatura*, a creature. These unfortunate beings are chiefly to be met with in the valleys of the Alps, particularly in the Swiss cantons of Valais, Vaud, Grisons, Glarus, Uri, and Aargau; but they are by no means confined to these parts, being much more extensively spread than was at one time supposed. Cretinism is often accompanied with goitre (which *see*). There are various degrees of Cretins; some seem to be sunk in intelligence below the level of many of the brutes; while others are able to go about and attend to some easy labour. Many are deaf and dumb, and without the sense of smell. Their habits are usually dirty and obscene. The Cretin seldom attains more than 4½ feet in height. The cranium is deformed, and has a conical shape, the forehead being thrown backwards, narrowed, and flattened, and the occiput being nearly on a line with the neck. The eyes are small, the nose broad and flat, the mouth large and open, with the tongue often protruded, and the whole countenance is idiotic. The flesh is soft and flaccid; the skin wrinkled, yellowish, or pale and cadaverous; the belly large and pendulous; the limbs crooked, short, distorted; and the gait imperfect and waddling. The cause of this infirmity is still matter of dispute among physicians. Some attribute it to the nature of the water, by which an undue amount of calcareous matter is conveyed into the system; others to the stagnation of the atmosphere in the deep narrow valleys. M. St. Lager, after long and careful investigation, decided that Cretinism is confined to metalliferous districts, and occurs most frequently where iron pyrites and copper pyrites abound. There are other causes that may possibly exert an influence upon it; as the poor diet and filthy, lazy, and intemperate habits of the people among whom it exists, together with the intermarriages among near relatives. There can be no doubt that it is in some measure hereditary, though all the children of a family are not affected by it. Many attempts have recently been made to improve the condition of the Cretin. The first thing to be done as soon as the disease manifests itself (for in many cases it does not appear till some time after birth—sometimes not before the sixth or seventh year) is to remove the sufferer to a pure bracing atmosphere. The treatment required is first to get the body into a healthy condition, by simple and nourishing food, warm clothing, frequent bathing and friction of skin, and gentle exercise. The development of the mind will follow that of the body, but must be done very gradually. Dr. Guggenbühl was the first that made any systematic attempt to educate the Cretin. He opened his institution on the Abendberg, in the canton of Bern, Switzerland, in 1840; and since that time several other institutions for the same purpose have been established on the Continent.

CRICKET, *krik'-et* (Dut., *krekel*), a genus of orthopterous insects, allied to grasshoppers and locusts, and the type of a family, *Gryllidæ*, or *Achetidæ*. The hinder legs are long, and adapted for leaping. The wings are folded horizontally. The cause of the chirping noise made by the cricket, and which is so familiar to the fireside listener during the cold winter evenings, is simply the friction of the wing-covers against each other. The house-cricket is about an inch in length, and the *antennæ* often half again as long as the whole body. It is found in various parts of Europe, more particularly in the south. In Great Britain it is very abundant. Only in the winter months does the cricket take up its abode with man, usually selecting rooms on the lower floor, and greatly affecting the kitchen, where there is generally no lack of food lying about. Sometimes it selects chinks and crevices in which to hide, and often burrows in the mortar, where, through the long evenings, it chirps continuously. There is a prevalent superstitious notion that the presence of a cricket in a house is a sign of good luck, and that suggested the title of Dickens' famous Christmas book, "The Cricket on the Hearth." The field-cricket is also found in this country, but is not nearly so common as the preceding species. It is exceedingly reserved in its habits, avoids man, and prefers hot, sandy localities; it burrows in the ground, and there lies all the year round. The field-cricket is carnivorous, and preys upon other insects. It is larger than the common species, and its chirp is much louder. Another interesting species is the mole-cricket (*Gryllotalpa*) whose habits are very singular, and greatly resemble those of the animal from which it is named. In its structure, too, there is a remarkable similarity. This insect is continually engaged in excavating galleries under the earth, some of which are of considerable dimensions. To enable it to do this with perfection, its anterior limbs are connected into a pair of flat fossorial (digging) organs, which are in appearance much like the hand of the mole. In its burrowing processes, it does great injury to the roots of plants. The female of this species prepares a large chamber wherein to lay her eggs, which are said to be from two to four hundred in number. Until after the first moult, the young remain together, but then take their departure, and commence burrowing on their own account. The mole-cricket is usually about two inches in length, and is of a brown colour. The most extraordinary cricket is that found in Sicily (*Gryllus megacephalus*), which chirps sufficiently loud, it is said, to be heard distinctly at a mile distant.

CRINOIDEA, *kri-noid'-e-a* (Gr., *krinon*, lily; *eidos*, likeness), an extensive order of animals, chiefly fossil, belonging to the class *Echinodermata*, and so named from their lily-like appearance. In existing seas, the crinoids are represented by the *Comatulæ*, or feather-stars of our own shores, and by the rare and all but extinct *Pentacrinites* of the West Indies. The principal fossil families are described under the head of ENCRINITE.

CRINUM, *kri'-num*, a genus of plants with bulbous roots, of the natural order *Amaryllideæ*, having large tubular flowers. There are many species, natives of tropical and sub-tropical regions, and cultivated in our hot-houses on account of their great beauty. An Indian species

(*C. amabile*) flowers four times a year. The bulbs of an Asiatic species are sometimes used as powerful emetics in cases of poisoning.

CRISIS, *kri'-sis* (Gr., *krino*, I decide), the decisive period or event of a disease—a sudden and considerable change of any kind, occurring in the course of its progress, and producing an influence upon its character. Among ancient physicians, it was applied to that tendency which fevers were supposed to possess, of undergoing a sudden change at particular periods of their progress. Hence there were what were called *critical* days—certain days in the progress of an acute disease on which a sudden change, either favourable or unfavourable, would take place. The seventh, fourteenth, and twentieth or twenty-first days, were regarded as eminently critical.

CRITHMUM, *krith'-mum*. (*See* SAMPHIRE.)

CROCODILE FAMILY, *krok'-o-dile* (Gr., *krokodeilos*), the largest order of the Saurian order of reptiles. The tail is flattened at the sides; there are five anterior and four posterior toes, of which the three inner ones only on each foot are armed with claws; all the toes are more or less joined by membranes. There is a single row of pointed teeth in each jaw; and the tongue is fleshy, fat, and attached very nearly up to the edges, which led to the ancient belief that the crocodile was without a tongue. The back and tail are covered with large and strong square scales, elevated into a ridge on their middle. There is a deeply denticulated crest on the tail, at the base of which the crest becomes double. The scales of the belly are squared, small, and smooth. The nostrils are opened at the end of the muzzle by two small crescent-shaped slits, closed by small valves, and lead, by a long and straight canal pierced in the palatine and sphenoidal bones, to the bottom of the back part of the mouth. As the lower jaw is prolonged behind the skull, the upper jaw has the appearance of mobility, but it only moves in concert with the whole of the head. The external ear is shut at will by two fleshy lips. The eye has three lids. Under the throat are two small glandular orifices, whence issue a musky secretion. Crocodiles are oviparous. Their eggs are deposited in the sand or mud on the banks of the rivers they frequent; and the young, when hatched, immediately proceed to the water. The egg of the crocodile is not much larger than that of the goose; but it is very much harder, and its form more oblong. The prey of the crocodile is chiefly fish, but it derives a considerably part of its sustenance by lying in wait in the evening at the water's edge, and hauling into the water any small quadruped that may come to drink. Crocodiles exceeding thirty feet in length have been killed in Upper Egypt. The colour, when full grown, is blackish-brown above, and yellowish-white beneath; the upper parts of the legs and the sides are varied with deep yellow, and parts of the body bear a green tinge. No living specimen of this family is found in Europe, nor has any at present been discovered in Australia. The double crested, or Indian crocodile (*C. biparcatus*), is very abundant, and also very dangerous in many parts of Asia. The crocodiles are generally considered as forming a natural passage from the saurians to the chelonians, to the last genera of which, in certain points of their conformation and habits, they nearly approximate. The *Crocodilidæ* are divided into two great families,—The crocodiles proper, which are distributed in the Old and New world and the alligators (including caymans), which are peculiar to America.

CROCUS, *kro'-kus* (Gr., *krokos*), a genus of plants belonging to the natural order *Iridaceæ*. From the species *C. vernus* and *versicolor* numerous varieties have been produced by cultivation, which are of great value in the flower-garden, on account of the early appearance and remarkable brilliancy of their flowers. *C. sativa* is the saffron crocus. (*See* SAFFRON.)

CROSS, THE SOUTHERN, the most conspicuous constellation in the southern hemisphere, consisting of four bright stars. The two stars which mark the summit and foot of the cross serve as pointers to the Antarctic pole.

CROSSBILL, *kros'-bil* (*Loxia*), a genus of birds of the family *Fringillidæ*, having some resemblance to the bullfinch. The range of the crossbill extends from the north of Europe and Asia to Greenland and North America. The most singular characteristic of this bird is its beak, the upper and lower mandibles being equally curved, hooked, and the elongated points crossing each other. Its favourite food is the fruit of the pine, and of the efficacy of the crossed mandibles in splitting and extracting the kernels from nuts there can be no doubt. The chief colour of the crossbill's plumage is ashy-grey, with a greenish tinge on the upper parts, while the lower parts are yellowish green. Its bill is horn-colour; its length about six inches. This is the plumage of the adult bird; after the first moult, however, and until the bird is a year old, all its upper and lower parts are of a tarnished red, more or less tinged with green and yellow; while the lower coverts of the tail are white, with a brown spot in the centre. Only three species are known; but one, the common crossbill (*L. carvirostra*) is frequently met with in this country.

CROSSOPODIA, *kross-o-po'-de-a*, a genus of annelids, now extinct, and the existence of which is inferred from markings on the surface of Silurian slates. They are supposed to have been worms about six inches in length.

CROTALARIA, *kro-ta-lai'-re-a* (Gr., *krotalon*, rattle; on account of the rattling of the seeds in their inflated pods, when shaken), a genus of plants belonging to the natural order *Leguminosæ*, sub-order *Papilionaceæ*. *C. juncea*, an Indian plant, furnishes a coarse fibre, called *sun*, *sunn*, *shunum*, *taag*, or *Bengal hemp*, which is often confounded with *sunnee*, the fibre of the *Hibiscus cannabinus*. *C. tenuifolia*, another Indian species, is the source of the Jubbulpore hemp.

CROTALUS. (*See* RATTLE-SNAKE.)

CROTON, *kro'-ton* (Gr., *kroton*, the dog-tick, in reference to the resemblance of the seeds to that vermin), a genus of plants belonging to the natural order *Euphorbiaceæ*. The seeds of the species *C. Tiglium*, and probably also those of *C. Pavana*, constitute the *croton*, or *tiglium seeds*, of the materia medica. The seeds are used without preparation, in India, as purgative pills. *C. Eleuteria* and *Cascarilla*, natives of the Bahama islands and Jamaica, yield the aromatic tonic bark commonly known as *cascarilla* or *eleutheria bark*. *C. pseudo-China* yields the *quilled copalche bark* of Pereira, and *C. suberosum* the *corky copalche* *bark* of the same author. In their medicinal properties the copalche barks resemble cascarilla. The aromatic bark known as *Malambo bark* is the produce of *C. Malambo*. It is extensively used in Columbia as a remedy in diarrhœa and as a vermifuge; also externally, in the form of an alcoholic tincture, in rheumatism.

CROTOPHAGA, *kro'-to-fa-ga* (Gr., tick-eater), a genus of birds of the order of the Climbers. *C. ani*, the Savanna blackbird, is common in the West Indies and tropical America. It feeds on berries and insects, and perches on the backs of horses or cattle and picks out and devours the troublesome ticks.

CROUP, *kroop* (Ang.-Nor.), an acute inflammation of the mucous membrane of the larynx, but frequently extending also to the trachea and bronchial tubes. It is very prevalent and fatal among infants, and is usually preceded by the symptoms of a common cold, with hoarseness and a harsh cough, pain in the head, fever, and swelling and redness in the back of the throat; but it may make its appearance suddenly during the night, and in the midst of apparent health. In a short time the respiration becomes noisy and difficult, accompanied by a crowing sound during inspiration; the face is red and swollen, the eyes suffused, the head thrown back, and everything indicates the great sufferings of the patient. In extreme cases as the disease advances, the breathing becomes more difficult, the cough more suffocating, the voice stifled, and the countenance livid; and gradual insensibility or convulsions at length close the scene. The fatal issue often takes place in thirty hours, and even less; but most frequently it happens about the end of the second day, though it has sometimes been known to run on to the fourth, fifth, or sixth day. The disease is most common between the first and tenth year, and rarely occurs after the age of puberty, though occasionally it is to be met with among adults. It is most common in cold, damp seasons and in low marshy localities. In so rapid and fatal a disease, medical advice ought to be immediately obtained. Bleeding, except by leeches, is not now generally approved of by medical men: some recommend emetics and purgatives; others opium and calomel. Warm bathing, or sponging with warm water, should be had recourse to, as well as the inhalation of a watery vapour.

CROW, COMMON, OR CARRION, *kro* (Sax., *crawe*) (*Corvus Corne*), the type of the family *Corvidæ*. The raven, jackdaw, and rook belong to the same genus. This common bird is spread over the Old and New continents, and feeds, like the ravens, on any sort of animal offal, or, when this is not attainable, on worms, moles, mice, caterpillars, grubs, beetles, &c. In the winter it associates with the rooks, and may be seen with them busily turning over the earth in search of food. The nest, like that of the rook, is constructed at the summit of a tree of slender branches, matted with clay and horse-dung. The hen lays four or five eggs of a palish green, sometimes blurred and spotted with a darker colour. They lay but once in the year, unless the young or the eggs be destroyed by accident. The hooded crow (*Corvus cornix*) is rather larger than the common crow, with black head, throat, wings, and tail. Its name is derived from the contrasted black head and grey body. It is more ferocious than the carrion crow, and has been known to pick out the eyes of lambs, and even of horses helplessly hampered in bogs. The Alpine crow, or chocard (*Pyrrhocorax alpinus*), has the compressed arched and sloped beak of the blackbird; but its nostrils are covered with feathers like those of the crow, to which it has been annexed. It builds in the clefts of rocks of the higher mountains, descending in immense flocks to the valleys. The nut-cracker crow is, although not a true crow, allied to the family in several particulars. It is not uncommon in many parts of Europe, but rarely visits England.

CROWBERRY. (*See* EMPETRACEÆ.)

CROWFOOT. (*See* RANUNCULUS.)

CROZOPHORA, *kro-zo-fo'-ra*, a genus of plants belonging to the natural order *Euphorbiaceæ*, and containing one remarkable species, namely, *C. tinctoria*, a native of the south of France. This yields, by expression, a green juice, which is converted, by the combined action of ammonia and the air, into the purplish dye called *turnsole*.

CRUCIAN, *kru'-se-an*, a fish (*Cyprinus carassius*) of the Carp genus, but larger. It is a native of the northern parts of Europe and Asia; but is occasionally found in the Thames (to which it has been perhaps introduced), and is known as the German carp.

CRUCIFERÆ, OR BRASSICACEÆ, *kru-sif'-e-re* (Lat., *crux*, cross; *fero*, I bear), the Cruciferous or Cabbage family, a natural order of exogenous plants in the sub-class *Thalamifloræ*. There are 195 genera, consisting of about 1,600 species, which are principally herbaceous plants. The general properties of the *Cruciferæ* are almost as definite as the botanical characters. The possession of antiscorbutic and stimulant properties, combined with an acrid flavour, may be said to constitute a universal character. The pungency of cruciferous plants depends on a volatile oil composed of carbon, hydrogen, nitrogen, oxygen, and sulphur. An oil expressed from the seeds is one of the most important products. None of the plants of the order, with one or two doubtful exceptions, are poisonous; many of them are esculent vegetables. The disagreeable odour emitted by them when decaying is attributed to the sulphur and nitrogen which they contain.

CRUST OF THE EARTH. (*See* GEOLOGY.)

CRUSTACEA, *krus-tai'-she-a* (Lat., *crusta*, a hard shell), a class of articulated animals whose external covering is less solid than that of the majority of testaceous mollusca, but much firmer and harder than the skin of the naked mollusca. In the larger animals, this covering contains a large amount of phosphate and carbonate of lime, and may be considered as intermediate between shell and bone. This skeleton may be regarded as a kind of epidermis, for beneath it is found a membrane like the true skin of higher animals. At certain times this solid envelope detaches itself and falls off, assisted by the efforts of the animal. Crustaceans have articulated limbs, and breathe by gills, being in that respect adapted for an aquatic life. The digestive organs are very simple, consisting of a short gullet, a large stomach, and a straight intestinal tube. The principal organ of locomotion in some crustacea, as the lobster and shrimp, is the abdomen, which terminates in fan-like appendages; and by bending the abdomen suddenly down under the thorax, they move swiftly backwards. The eggs are carried, during incubation, under the abdomen or thorax of the female. Many crustacea, especially the crab, undergo curious metamorphoses. The greater number are marine, some inhabiting fresh water.

CRYOLITE, *kri'-o-lite*, a double fluoride of aluminium and sodium, the source of the metal aluminium. (*See* ALUMINIUM.)

CRYOPHORUS, *kri-of'-or-us* (Greek, *kryos*, cold, and *phero*, I carry), a glass tube, with a bulb at each end, used for performing the experiment of making ice. In one of the bulbs is water, in the other water vapour. When the apparatus is placed in a freezing mixture (*see* FREEZING MIXTURES) the vapour condenses, and more vapour rises from the water in the other bulb, causing an abstraction of heat and the freezing of the water. The operation of the instrument is thus explained—We know that heat determines the form in which matter exists, and that as gas is a liquid *plus* heat, and therefore requires heat for its production. In the cryophorus we have a certain amount of aqueous vapour, the pressure of which upon the water in the distant bulb prevents further evaporation—in fact, the vacuum is saturated; but when the vapour is condensed by the freezing mixture, the pressure disappears and the water emits its vapour into the resulting vacuum, and thereby loses heat, since the water requires heat before it can become vapour. When this vapour is condensed, a further quantity is supplied by the water which is still more chilled, and this action continues until it is frozen by its own evaporation.

CRYPTOGAMOUS PLANTS, *krip-to-ga'-mus*, the lowest in organization of all the members of the vegetable system. They have no true flowers, and no known organs of fructification. The seeds, or spores, germinate indifferently from any point. (*See* ACOTYLEDONS.)

CRYSTALLINE LENS, *kris'-tal-line* (Lat., *crystallus*, a crystal; *lens*), the lens of the eye. (*See* EYE.)

CRYSTALLIZATION, *kris-tal-li-zai'-shun*, the spontaneous assumption of well-defined geometrical forms by bodies in passing from the fluid or aëriform state to the solid condition. Bodies not capable of assuming the crystalline form are termed *amorphous* or *colloid*; those which form crystals, *crystalloid*. When a substance crystallizes in two distinct forms, which cannot be derived from the same original, it is said to be *dimorphous*. Sulphur, for instance, will crystallize in octahedra or prismatic crystals. Some substances are even *trimorphous*. Sulphate of nickel crystallizes in right rhombic prisms, square-based octahedra, and oblique rhombic prisms, according to the temperature at the time of evaporation. Bodies crystallizing in similar forms are called *isomorphic*. The alums and fluor spar: carbon, gold, copper, and their compounds; the potassium compounds of chlorine, iodine, bromine, and fluorine, form *isomorphous* groups.

CTENOID FISHES, *te'-noid*, an order of fishes characterised by rounded or ovoid scales, with sharp projections on the outer margin. Turbot, flounders, and perches are examples.

CUBE, *kube* (Gr., *kubos*, a die), a solid body with six square equal faces, and occupying among bodies a place analogous to that of the square among surfaces. It is also called the hexahedron, by reason of its possessing six sides. One of the most perplexing of all geometrical problems has exercised the minds of mathematicians from the time of Hippocrates of Chios to that of Descartes—to find the side of a cube the contents of which should be twice the size of another given cube. It was known as the Delian problem, from the tradition that the oracle of Apollo in the island of Delos, told the people that they must make the altar of Apollo, of cubic form, twice the size, to obtain relief from a pestilence. The alter was enlarged by adding another cube of the same size, but that did not satisfy the oracle, as the form of a cube was lost. Descartes proved that the solution was impossible by geometry; but in arithmetic it can be arrived at by the extraction of the cube root.

Cube Root.—In Arithmetic, the cube of a number is the product of its multiplication three times by itself, and that number is the "cube root." Thus, 5 is the cube root of 125, because $5 \times 5 = 25 \times 5 = 125$.

Cubic Equations. (*See* EQUATIONS.)

CUBEBA, *ku-be'-ba* (Arab., *cubabah*), a genus of plants belonging to the natural order *Piperaceæ*. The species *C. officinalis*, a native of Java and Prince of Wales' Island, yields the berries called cubebs, which are extensively employed in medicine for their peculiar power of arresting excessive discharges from the urethra. Cubebs resemble black pepper, but may be distinguished by the network of raised veins on their surface, also by the short stalks which they possess.

CUCKOO, *koo'-koo* (Lat., *cuculus*; Fr., *coucou*) (*Cuculus canorus*).—This bird (the type of the family *Cuculidæ*, which includes many species), which derives its name from the peculiar sound of its note, is very widely diffused. It is found in India and in Africa, and migrates northward in summer, even to Lapland and Kamtchatka. It makes its appearance in England in April, and disappears again by about the middle of August. The tail is long and rounded, the wings long, and the toes are so placed as to give great facilities for grasping branches. There is no pairing or continued attachment between the male and female, and the latter generally, if not always, lays her eggs in the nest of some other smaller bird, leaving their hatching and future maintenance to fate. The gratitude of the foster child is of a piece with its parent's heartlessness; for as soon as it attains sufficient size and strength, it ejects the eggs or the young birds, the true offspring of the birds which have hatched it. The hedge-sparrow, the pied wagtail, and the yellow-hammer, are the birds commonly selected by the cuckoo for imposition. The gilded cuckoo (*Cuculus auratus*) is an inhabitant of the Cape of Good Hope, and extremely common in Kaffraria. It is a very beautiful bird, the chief of the plumage being brilliant green with golden reflections. It is about seven inches long. Like the common cuckoo, it deposits its eggs in the nests of other birds, but is supposed to carry them thither in its mouth. The spotted cuckoo (*Oxylophus glandarius*) is an inhabitant of the north of Europe; the oriental cuckoo (*Eudynamys orientalis*) is found in the East Indies; and there is also the yellow-billed American cuckoo (*Coccyzus americanus*), likewise called the cow-bird and the rain-crow.

CUCKOO-FLOWER. (*See* CARDAMINE.)

CUCKOO-PINT. (*See* ARUM.)

CUCUMBER, *ku'-kum-ber* (*Cucumis*), a genus of plants belonging to the natural order, *Cucurbitaceæ*. The fruit of *C. sativus* is the common cucumber, a native of Asia, but which has been cultivated in Europe for very many centuries as a favourite article of food. There are many varieties, some only a few inches long, some approaching two feet. Although in some of the southern counties of England cucumbers are grown in open fields, hotbeds with lights are generally required. Long cucumbers, "gherkins," are pickled. Cucumbers were brought into England from the Netherlands about 1538.

CUCURBITACEÆ, *ku-kur-bit-ai'-se-e*, the Gourd or cucumber family, a natural order of dicotyledonous plants in the sub-class *Calyciflorœ*. Upwards of 60 genera have been described, and these include more than 300 species. The plants are mostly herbaceous, natives of hot climates in almost every part of the world; they abound in the East Indies; many occur in Peru and Brazil; a few are found in Europe and North America; and one species only, *Bryonia dioica*, in the British isles. They are all herbs with tuberous or fibrous roots, which are annual or perennial, and with stems which are generally succulent, and either prostrate or climbing by means of tendrils. An acrid, bitter, purgative principle characterises the plants of this order, and is especially evident in the pulp surrounding the seeds. In some cultivated species the acridity is scarcely perceptible, and the fruits are edible. To this order belong the cucumber, melon, pumpkin, vegetable marrow, and the numerous gourds. (*See* separate headings.)

CUDBEAR. (*See* LECANORA.)

CUDWEED, *kud'-weed*, a name commonly given to various species of plants of the natural order *Compositæ*. They are small, and the heads of the flowers may be kept for a long time without decaying.

CUICHUNCHULLI, *kwi-kun-kool'-e*, a plant (*Ionidium parviflorum*) of the natural order *Violaceæ*, a native of Peru. It is shrubby, with very small leaves, possessing active emetic and purgative properties. The species is commonly known as white ipecacuanha.

CULEX, *ku'-leks* (Lat., a gnat), a genus of the *Diptera* or two-winged insects, constituting the Gnat family. They are characterised by their length of proboscis and their finely-tufted antennæ. (*See* GNAT, MOSQUITO.)

CULM, *kulm*, a slaty kind of anthracite, occurring in Wales and North Devon. The strata in which it is found are often called the *culm measures*.

CULMINATION, *kul-min-ai'-shun* (Lat., *culmen*, the top of anything).—When any heavenly body is on the meridian, it has then attained the highest point of its daily course, and is therefore said to culminate. The sun culminates at mid-day, the moon at midnight, when it is full moon.

CUMINUM, *ku-mi'-num* (Gr., *kuminun*), a genus of composite plants. *C. Cyminum*, the cumin, is a dwarf fennel-looking plant, cultivated in the south of Europe and Asia Minor, for its fruits, which are hot and aromatic, like those of the caraway and anise. The fruit is used as a carminative, and with resin as a plaster, but chiefly in veterinary practice. In Germany it is often put into bread.

CUNNINGHAMIA, *kun-ning-ha'-mi-a*, the name given to a genus of trees of the natural order *Coniferæ*, in general characteristics resembling the pines and firs, but differing in the foliage.

CUNONIACEÆ, *ku-non-e-ai'-se-e*, a natural order of dicotyledonous plants in the sub-class *Calyciflorœ*. They are nearly allied to the *Saxifragaceæ*, but differ from them in being trees or shrubs, with opposite leaves and large interpetiolar stipules. They are natives of South America, the Cape, the East Indies, and Australia. Most of them have astringent properties, and some have been used for tanning.

CUPANIA, *ku-pai'-ni-a* (in honour of Cupani, an Italian monk and botanist), a genus of plants belonging to the natural order *Sapindaceæ*. The species *C. sapida* flourishes in the West Indies, and the distilled water of the flowers is used by the negro women as a cosmetic, and the seed is eaten for dessert. The fruit containing the seeds is commonly known as the akee-fruit.

CUPILIFERÆ, *ku-pil-i-fer'-e*, a name given by some botanists to the Oak or Mastwort order. (*See* CORYLACEÆ.)

CUPPING, *kup'-ping* (from the cup-like form of the glasses employed), the application of cupping-glasses, from which the air has been previously extracted, to the skin, with the view of attracting blood to the part, and, if necessary, abstracting it. Cupping was practised by the ancients, and is frequently had recourse to in the present day. In performing the operation, a small bell-shaped glass, from which the air has been partially expelled by holding it for an instant over the flame of a spirit-lamp, is applied to the spot, and the usual amount of pressure on the part being thus diminished, the blood flows towards it, producing a distension of the blood-vessels and an elevation of the surface. This is called *dry cupping*, and is frequently of great service in the removal of certain kinds of pain. When it is intended to abstract blood, the cupping-glass is removed as soon as the part is sufficiently swollen, and the scarificator applied to it. This instrument contains a number of lancets (usually about ten or twelve), which, by touching a spring, are made to inflict a corresponding number of wounds, the depth of which may be regulated by the operator. Immediately on the wounds being made, the cupping-glass is applied, exhausted as before, and the blood allowed to flow into it until a sufficient quantity has been extracted. Cupping is preferable to any other method of blood-letting in many kinds of inflammatory disease; and the operation requires so much skill that it is generally practised as a separate branch of the surgical profession.

CUPRESSUS, *ku-pres'-sus* (Gr., *kuo*, I produce; *parisos*, equal, because it bears equal branches), the Cypress, a genus of plants belonging to the natural order *Coniferæ*. *C. sempervirens* is a common timber-tree in some parts of the Levant. Its dark foliage is particularly impressive when seen near architectural works; and on this account the tree was always planted by the Moors round their splendid palaces, and by the Romans near their villas. In the burial-grounds of Turkey and Arabia, the tombs of the faithful are generally shaded by the cypress. The timber of this and other species are very durable, and is said to resist the worm. The doors of St. Peter's church at Rome are of cypress-wood, and have lasted upwards of 1,100 years. It is supposed that the gopher-wood of the Bible was chiefly obtained from a species of this genus.

CUPULIFERÆ, OR CORYLACEÆ, *ku-pu-lif'-e-re*, a natural order of exogenous plants, so named from bearing cupules, or cups formed by a number of cohering bracts, surrounding the fruit or the base of the fruit, as in the acorn and hazel-nut.

CUPRITE, *ku'-prite*, the red oxide of copper, which is also known as octahedral copper-ore, from the form of its crystals.

CURASSOU, OR HOCCO, *ku-ras'-so, hok'-ko*, a genus (*crax*) of large gallinaceous birds of the family *Cracidæ*. They are natives of the forests of tropical America. The bill is strong, and surrounded at the base with a skin sometimes brightly coloured. They live in flocks, and are easily domesticated. The most familiar species (*C. Alector*) is about the size of a turkey, and of black colour. It is commonly kept in poultry yards in South America, and the flesh is tender and of agreeable flavour.

CURCULIO, *ker-ku'-li-o*. (*See* WEEVIL.)

CURCUMA, *kur-ku'-ma* (Arab., *kurkum*), a genus of plants belonging to the natural order *Zingiberaceæ*. The dried tubers or rhizomes of *C. longa* constitute the *turmeric* of the shops. (*See* TURMERIC.) The rhizomes of another species, *C. angustifolia*, contain much starch, which forms East Indian arrowroot, or curcuma starch.

CURLEW, *kur'-lew* (Fr., *courlis* or *corlieu*, a bird of the genus *Numenius* of the order *Grallatores*, and of the same family as the snipe and woodcock. The common curlew (*N. arquata*) is characterized by a long, slender, incurved bill, slightly compressed and furrowed for three-fourths of its entire length; it has a blunt tip; wings ample; tarsi naked above the joints. In length the curlew measures about two feet, and, in the case ef the male, the whole plumage is bright ash-colour, with longitudinal brown spots on the head and breast; upper mandible blackish brown; lower mandible flesh-colour; iris brown; feet deep ash. The curlew is very common in most parts of Europe, and occurs in parts of Asia. It inhabits the vicinity of waters and marshy wastes, and feeds on earth-worms, slugs, small testaceans, and insects. Its nest, a careless construction of dried grass and leaves, is usually placed among the rushes. Its eggs are large, over two and a half inches in length, of an olive-green colour blotched with deep brown. A smaller species is known as the whimbrel (*N. phæopus*), and there is the Esquimaux curlew (*N. borealis*).

CURRANTS, *kur'-rants* (from Corinth, where they were originally grown), the dried fruits of a variety of the grape-vine, now extensively cultivated in Zante and several other of the Greek islands. The currants of English gardens, red, white, and black, are the produce of species of *Ribes* (which *see*).

CURRENTS, *kur'-rents* (Lat., *currere*, to run), the name given to water running in any direction, and, in navigation, to the courses in which the water in certain parts of the ocean is always moving, with a constant and generally uniform motion and in the same direction. These currents greatly tend to accelerate or retard the motion of any vessel that comes within their influence. Two different kinds are to be distinguished in the ocean—the drift current and the stream current. Ocean currents are of great breadth, and in some cases sweep across from one continent to another. (*See* EQUATORIAL CURRENT, GULF STREAM, OCEAN, and TIDES.)

In Electricity, the electrical current is the passage of the electric fluid from one pole of an apparatus to another. (*See* ELECTRICITY.)

CURVE, *kerv*, in Geometry, a line which, running on continually and gradually in all directions, may be cut by a right line in more points than one. The theory of curves forms a very important branch of the higher portion of mathematical science; but only those curves that follow some law in their change of direction can form the subject of geometrical speculation. The law of the circle is that all portions of the curve are equidistant from one point called the centre. Descartes divided all curves into two classes—*geometrical* and *mechanical*. It is now the custom to indicate the same distinctions by the the terms *algebraic* and *transcendental*. The curve is called algebraic when its equation only contains the powers of x and y; and it is called transcendental when the equation contains other functions, such as logarithms of x and y. Algebraic curves are divided into different orders, according to the degree of the equation which expresses the relation between their co-ordinates. Straight lines are said to be of the first order, because the equation of a straight line contains no powers or products of the variables x and y. Curves of the second order are those of which the equation rises to two dimensions, and the curves which it includes are the circle, the ellipse, the hyperbola, and the parabola. Out of the infinite number of curves that can be drawn, very few comparatively have received definite names. Subjoined is a list of the curves that are of usual occurrence: circle, ellipse, hyberbola, parabola, semi-cubical parabola, cissoid of Diocles, conchoid of Nicomedes, trisectrix, lemniscata, cycloid, companion of the cycloid, harmonic curve, trochoid, epicycloid and cardioide, hypocycloid, epitrochoid, hyptrochoid, curves of sines, cosines, tangents, &c., exponential or logarithmic curve, spiral of Archimedes, logarithmic spiral or equiangular spiral, reciprocal spiral, lituus quadratus of Dinostratus, quadratrix of Tchirnhausen, octenary tractory, tractrix, syntractory, ovals of Cassini, Watt's parallel-motion curve.

In Geology, the terms *anticlinal* and *synclinal curves* are applied to the elevations or depressions in undulating strata. The wave of the ridge in the anticlinal, and the trough of the valley, the synclinal curve.

In Magnetism.—The lines into which iron filings arrange themselves under the influence of a magnet are called magnetic curves. The lines thus traced are of great interest, as they show the lines of magnetic force due to the particular arrangement of magnetic matter used.

CUSCO-CHINA, *kus'-ko*.—Three different barks pass under this name, one the produce of *Cinchona scrobiculata*, called in Peru red Cusco bark. The second appears to be the produce of *Chinchona pubescens*. There is also a third, which is, perhaps, the white Jaen. The alkaloid is procured by the same process as is used for cinchonia, which it resembles in its physical qualities; but differs from in its chemical habitudes. The taste is more bitter, rather heating, and sub-astringent.

CUSCUTACEÆ, *kus-ku-tai'-se-e*, the Dodder family, a small natural order of dicotyledonous plants, which is generally regarded as a subdivision of *Convolvulaceæ*. The plants composing it are distinguished from those of that order by their parasitic habit, by the absence of leaves, by the tube of the corolla being furnished with scales alternating with the segments, and by having a thread-like coiled embryo with almost obsolete cotyledons. They are chiefly natives of temperate climates, and are often very destructive to flax, clover, and other crops.

CUSP, *kusp* (Lat., *cuspis*, a point).—When two curves touch, or appear to touch each other, and terminate in a point at which they have a common tangent, this point is called the cusp of the curve. Cusps are of two kinds: in one, the tangent lies on one side of both curves, and their convexities are both turned in the same direction towards the tangent; in the other the tangent lies between the curves, and their convexities are turned towards the tangent in opposite directions.

CUSPARIA BARK. (*See* ANGUSTURA BARK.)

CUSSO. (*See* KOSSO.)

CUSTARD-APPLE. (*See* ANONA.)

CUTANEOUS DISEASES. (*See* SKIN, DISEASES OF THE.)

CUTICLE. (*See* SKIN.)

CUTTLE-FISH, *kut'-tl fish* (Ang.-Sax.), a molluscous animal of the genus *Sepia*, order *Cephalopoda*. The body is somewhat oval, but broader at the head than at the extremity, which is obtusely pointed, The eyes are very large; and the head is furnished with eight arms and two feet, the latter being nearly similar in structure to the arms or tentacula, but considerably longer in their dimensions. A neck divides the head from the body, which is furnished on each side, throughout its entire length, with a narrow fin. The back of the cuttle-fish is strengthened by a calcareous plate, well known as the *cuttlefish-bone*. This bone was in former times in great repute among apothecaries as an absorbent; but now it is chiefly used in the form of a powder, to polish the softer metals. The term bone, however, is properly inapplicable to the calcareous shield of the cuttle-fish; as in its composition it is exactly similar to shell, and consists of various membranes hardened by carbonate of lime, without the smallest mixture of phosphate. This animal is sometimes termed the ink-fish, a name that arises from the circumstance that beneath its throat is a bladder, in which is secreted a fluid black as the blackest ink, and which, when annoyed or pursued, it ejects, so staining the water around it, that it is an easy matter for it to escape unperceived. This fluid furnishes the valuable pigment sepia. It likewise possesses the chameleon-like power of changing its colour. The eggs of the cuttlefish are cast ashore, often in clusters, and are commonly known as sea-grasses.

CYANIC ACID, *si an'-ik*. (*See* CYANOGEN.)

CYANITE, *si'-an-ite* (Gr., *kuanos*, blue), a mineral belonging to the garnet family, occurring in broad prisms in mica and talc schists, and composed of alumina and silica. Transparent cyanite is often used for sapphire; but it may be known by its inferior hardness.

CYANOGEN, *si-an'-o-jen* (Gr., *kuanos*, blue, and *gennao*, I produce). Cyanogen, or bicarbide of nitrogen, is one of the most interesting of the carbon compounds, its discovery by Gay-Lussac in 1814 having thrown considerable light upon two important facts in chemical science—the existence of compounds acting as elements, and of substances having the same ultimate composition, but different properties. In fact, it was the means of originating new theories with respect to organic bodies generally. The name *cyanogen*, was bestowed on this substance in consequence of its forming an essential ingredient in Prussian blue.

CYANOSIS, OR BLUE DISEASE, *si-an-o'-sis* (Gr., *kuanos*, blue), a diseased condition of the system, arising from a malformation of the heart, which, allowing the intermixing of the venous with the arterial blood, in consequence of which the former is not properly oxygenized, and a blueness is imparted to the skin, whence the disease takes its name, and the capillaries and minute veins, especially of the face, are overcharged.

CYATHEA, *si-a'-the-a*, a genus of ferns of the sub-order *Polypodiaceæ*. There are many species, tree-ferns of great beauty, natives of tropical and sub-tropical regions. The common tree-fern (*C. arborea*) is a native of the West Indies and Brazil. The roots of a New Zealand species (*C. medullaris*) are baked and eaten as food.

CYATHOPHYLLUM, *si-ath-of-il'-um*, fossil corals, very abundant in the Devonian strata.

CYCADACEÆ, *si-ka-dai'-se-e*, the *Cycas* family, a natural order of dicotyledonous plants, in the sub-class *Gymnospermia*, consisting of small palm-like unbranched trees or shrubs, with stems marked by the scars of leaf-stalks. In a few species the stem divides in a forked manner, and leaves are clustered at the summit. The plants are principally natives of the temperate and tropical parts of America and Asia, and are also found occasionally at the Cape of Good Hope, in Madagascar, and Australia. Their stems and seeds yield mucilage and starch. The product known as Japan sago is obtained from the cellular substance of the interior of the *Cycas revoluta*, and a similar product is obtained from other trees in the Indian Archipelago and in Mexico.

CYCADITES, *si'-ka-dites*, fossil plants of the oolite and chalk, apparently allied to the existing *Cycadaceæ*. The leaves are only known.

CYCHLA, *si'-kla*, a genus of fishes of the *Chromidæ* family, found in the rivers of tropical America. They are remarkable for the beauty of their colours, and their flesh is considered a delicacy.

CYCLAMEN, *si'-kla-men*, a genus of plants of the order *Primulaceæ*, chiefly natives of the south of Europe, and herbaceous perennials. They are cultivated in this country as spring garden flowers, being very beautiful and fragrant. The underground stems are acrid, but pigs are very fond of them, which gives rise to the common name "sow-bread;" and an ointment is prepared from them which, applied externally, assists to expel intestinal worms from children.

CYCLOBRANCHIATA, *si-klo-brank-i-a'-ta* (Greek, circle-gilled), an order of gasteropodus mollusca including the limpets and chitons. The gills generally form a series of lamellæ, surrounding the body.

CYCLOID, *si'-kloid* (Greek, circle-like), the curve described by a point on the circumference of a circle rolling along a straight line on its own plane. The properties of this curve are very interesting to geometricians; and it is sometimes known as the isochronous, or equal time curve, from the fact that the time occupied in the descent of a body from rest from any point in the arc of an inverted cycloid, is the same from whatever point of the curve the body begins to descend; and having reached the lowest point, will, through the impetus received in the fall, ascend the opposite side of the curve to a height equal to that from which it fell, occupying exactly the same time in ascending as it did in descending.

CYCLOID FISHES, fishes having scales formed of concentric layers, not always overlapping, and not covered with enamel. Fossil fishes of this character are very numerous in the more recent strata.

CYCLONES. (*See* STORMS.)

CYCLOPS, *si'-klops*, a genus of minute crustaceans of the order *Branchiopoda*. The soft and gelatinous body is divided into two portions, one consisting of the head and thorax, the other of the tail. There is only one eye, generally of a bright crimson colour. There are many species, both in salt and fresh water, generally found among aquatic plants.

CYDONIA. (*See* QUINCE).

CYGNET, a young swan. In Heraldry, a cygnet royal is a swan with a ducal coronet and a chain.

CYGNUS, *sig'-nus*, (Lat., *cygnus*, a swan), a constellation in the northern hemisphere, situated between those of Cassiopeia and Lyra. Its brightest star is one of the second magnitude.

CYLINDER, *sil'-in-der* (Gr., *kulindo*, I roll), a solid body which has three surfaces, one of which is convex and continuous, and the other two parallel. A right cylinder is one in which the line joining the centres of the limiting circles is perpendicular to their plane. All other cylinders are oblique. A right cylinder, taken in this view, may be conceived as described by a rectangular parallelogram, revolving about one of its sides.

CYMA RECTA, *si'-ma rek'-ta* (Lat., *cyma*, a little shoot, a branch; *recta*, right), in Architecture, the name given to a moulding which somewhat resembles the letter S, hollow in the upper part and projecting below. When this order is changed, and the projection is above instead of below, the moulding is called *cyma reversa*. The upper part of the cornice of an entablature, being generally in the form of this moulding is known as the *cymatium*.

CYME, *sime* (Gr., *kuma*, a sprout, a common, term for the different kinds of definite inflorescence; that is to say, for every inflorescence formed of a terminal flower, beneath which are lateral branches, each having a terminal flower, and the lateral branches again similarly dividing, and so on.

CYNANCHUM, *si-nan'-kum*, a genus of plants of the natural order *Asclepiadaceæ*, having a wheel-shaped corolla. The *C. Monspeliacum*, a herbaceous twining plant, growing on the shores of the Mediterranean, yields a strong purgative drug known as Montpellier scammony. From *C. ovafolium*, a native of Penang, caoutchouc is obtained.

CYNARA, *sin-ai'-ra* (from Gr., *kuon*, a dog, in allusion to the spines of the involucrum), a genus of plants belonging to the natural order *Compositæ*. It includes the *artichoke* and *cardoon* (which *see*).

CYNODON, *si'-no-don*, a genus of grasses, with epitelets on one side. The principal pasture grass of India known as *dhob*, or *doorba*, belongs to this genus.

CYNOMORIUM, *si-no-mor'-i-um*, a genus of parasitic plants of the natural order *Rhizanthaceæ*. A fungus-looking species, *C. coccineum*, grows abundantly in Malta and the neighbouring island Gozzo, and is highly valued as a styptic and astringent. The old knights of Malta valued it so highly, that the grand master sent it as a present, of this "fungus Melitensis" to kings and princes. A keeper of the rock on which it grows is still appointed by the Government.

CYNOSURE, *si'-no-sure* (Greek, *kunosoura*, the tail of the dog), the constellation Ursa Minor, or the Little Bear, of which the principal star is the pole-star. As the other constellations appear to revolve round this, the word is used in poetry (especially by Milton, in *L'Allegro*), to express some central object on which all eyes are fixed.

CYPERACEÆ, *si-per-ai'-se-e*, the Sedge family, a natural order of monocotyledonous plants in the sub-class *Glumaceæ*, consisting of grass-like or rush-like herbs, natives of all parts of the world, and found especially in marshes, ditches, and the neighbourhood of running streams. The stems are solid, often angular, and are without joints or diaphragms. Although closely allied to the *Graminaceæ* (grasses), the plants of this order are of little use to man, their seeds being deficient in those nutritive qualities which render the seeds of the cereals so valuable. There are about 2,000 known species. The rhizomes, tubers, or corms, of some species of the typical genus *Cyperus* were formerly employed in medicine as aromatic tonics and astringents. The *C. esculentus*, or rush-nut is cultivated in southern Europe, and the farinaceous tubers are called by the French earth-almonds. They contain oil, and on that account are largely exported. In India, the tubers of some species are cooked and eaten; and the fibre of *C. textilis* is used for making mats.

CYPRINIDÆ, *si-prin'-i-de*, a family of malacopterous (soft-finned) fresh-water fish, including carp, barbel, dace, roach, and other well known fish abounding in lakes and rivers. *Cyprinadontidæ* is the name given to a family of fishes, found in America and Asia, both in fresh and salt-water, similar in general characteristics to the *cyprinidæ*, but with more protractile and toothed jaws. (*See* ANABLEPS.)

CYPRIS, *si'-pris*, a genus of minute thin-shelled crustaceans, of the order *Branchipoda*. (*See* BRANCHIPODA.) They are found in almost any pool of stagnant water, and the long fringed bristles attached to the antennæ and feet enable them to move with great rapidity.

CYRILLACEÆ, *si-ril-lai'-se-e* (in honour of Cyrillo, a Neapolitan botanist), the *Cyrilla* family, a small natural order of dicotyledonous plants in the sub-class *Thalamifloræ*, consisting of evergreen shrubs, nearly related to *Olacaceæ*, but distinguished by their petals, which are altogether free from hairiness on the inside, and by the stamens being all fertile, and, if equal in number to the petals, alternate with them. They are natives of North America.

CYST, *sist* (Gr., *kustis*, a bladder), the urinary bladder, gall-bladder, and similar vessels in the human body; but the term is also applied to morbid growths within the body, having the form of a bag or bladder, and inclosing matter.

CYSTIC WORMS. (*See* ENTOZOA and TAPEWORM.)

CYTISUS, *si'-tis-us*, a genus of leguminous trees and shrubs, of which the laburnums and broom are well-known examples. There are many species, chiefly natives of the warmer temperate parts of the world. The yellow, white, or purple flowers are very beautiful. The timber of the tree-laburnum (*C. alpinus*) is much prized by cabinet-makers and turners for its hardness, beauty of grain, and durability.

CYTTARIA, *sit-tai'-re-a*, a genus of fungi. *C. Darwinii* and *Berteroi* are employed for food; the former in Terra del Fuego and the latter in Chili.

D.

DAB, *dab* (*Pleuronectes limanda*), a common flat fish known in the London market. Its average size is eight or nine inches in length, and six or seven in breadth. Its upper side is pale brown, and its under parts white. It abounds on all sandy parts of the British coasts, and is usually caught with plaice and flounders.

DABCHICK. (*See* GREBE.)

DACE, *dais* (Du., *daas*) (*Leuciscus vulgares*), a small fish of the family *Cyprinidæ*, found in clear and quiet streams. Its head is small, muzzle pointed; back a little elevated, and tail slightly forked. The scales of the dace are rather small. It is gregarious. The food is worms and other soft animal substances.

DACRYDIUM, *da-krid'-i-um* (Gr., *dakru*, a tear), a genus of plants belonging to the natural order *Taxaceæ*, or Yew family. It includes several valuable timber trees; as, the Huon pine of Australia (*D. Franklinii*), the Kakaterro of New Zealand (*D. taxifolium*), which grows to a height of 200 feet, and is valuable for the timber, and the Dimon pine (*D. cupressinum*).

DACTYLIS, *dak'-til-is* (Gr., *daktulos*, a finger), a genus of Grasses. The species *D. cæspitosa*, is the tussac-grass of the Falkland Islands, which forms an excellent kind of fodder for cattle. It is now grown to some extent in Shetland and other parts of Britain.

DADYL. (*See* CAMPHENE.)

DAHLIA, *da'-li-a* (from Dahl, a Swedish botanist), a genus of perennial herbaceous plants of the order *Compositæ*, sub-order *Corymbiferæ*. They are natives of Mexico, from which they were brought by Spanish botanists in 1789. Early in the present century they became favourite ornaments of English flower-gardens. There are two species, *D. variablis* and *D. coccenæ*, from which by the skill of the cultivators about 2,000 varieties have been produced. The "points" of a fine dahlia are fulness of flower, and the absence of an eye or disc. The roots are tuberous, and require to be taken up for the winter, and stored in a dry place out of the reach of frost till the spring. Dahlias are propagated by seed, by cuttings, and by tubers, and sometimes the finer varieties are grafted on more ordinary stocks. The dahlia was introduced into Russia and Germany by a botanist named Georgi, and from that circumstance it is known in Germany as the Georgina.

DAISY. (*See* BELLIS.)

DAISY, MICHAELMAS. (*See* ASTER.)

DALBERGIA, *dal-ber'-je-a*, (after Dalberg, a Swedish botanist), a genus of leguminous plants of the sub-order *Papilionaceæ*. Several species are good timber trees, the most valuable being *D. Sissoo*, which furnishes the Indian wood called sissoo or sheeshum. From *D. latifolia*, East-Indian ebony or black-wood is obtained; and *D. monetaria*, a native of Surinam yields a resin.

DALTONISM. (*See* COLOUR.)

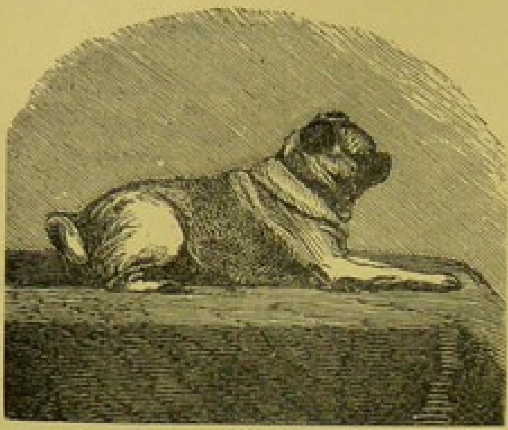
DAMAN, a genus of small quadrupeds (*Hyrax*) forming a connecting link between the *Rodentia* and *Pachydermata*. Cuvier spoke of them as, "except the horns, little less than rhinoceroses in miniature." The Syrian daman is supposed to be the cony of the Bible. (*See* CONY.) Other species differing in some particulars are met with in Abyssinia and South Africa.

DAMMARA, *dam'-ma-ra*, a genus of coniferous trees, including two remarkable species. *D. Australis*, the kawrie or cowdie pine of New Zealand, furnishes excellent timber for masts and spars, and also yields a gum-resin, which is now largely imported into this country under the names of Australian copal, kawrie gum, and Australian dammar. It is chiefly used in the preparation of varnishes. *D. orientalis* yields a somewhat similar gum-resin, which is known as Indian dammar.

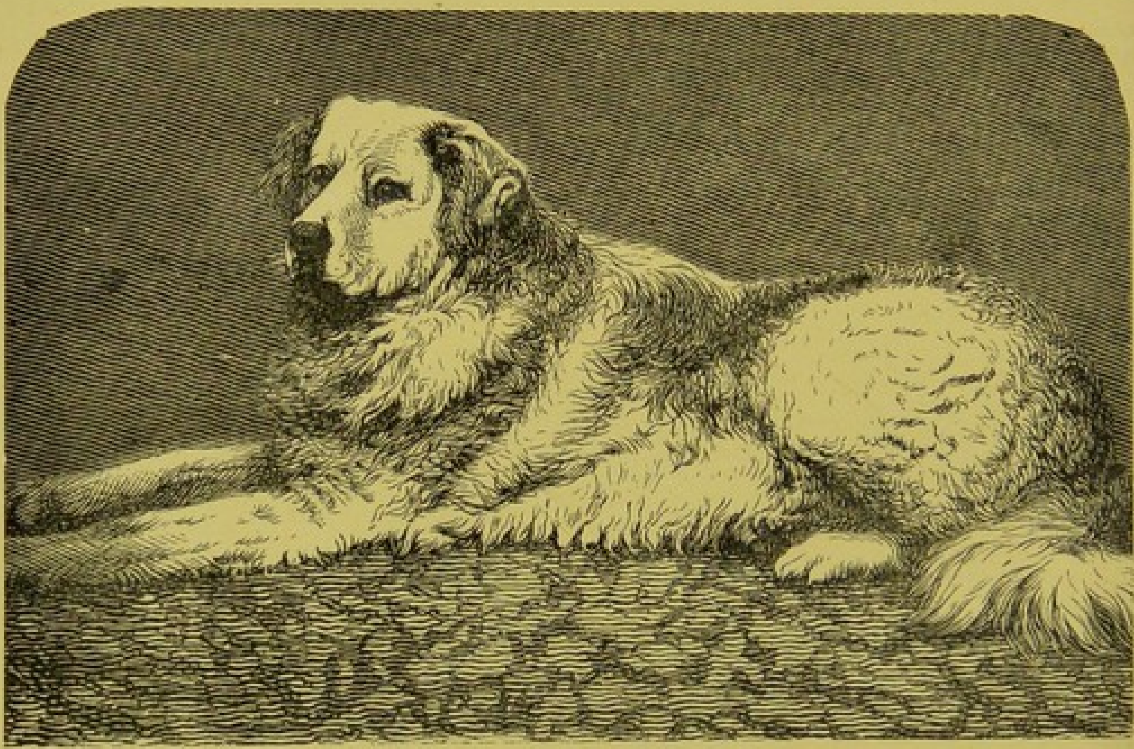
DAMSON, *dam'-son* (from *Damascere* of Damascus), a small variety of the common plum, with fine flavoured acid fruit. Preserves, tarts, and so called "cheese" are made from this fruit.

DANÆEÆ, a sub-order of Ferns. (*See* FILICES.)

DANCING MANIA, an epidemic disorder among susceptible subjects, in which imitation is brought about under high excitement. It is


PUG.


SKYE TERRIER.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DALMATIAN.


BULL TERRIER.

DOGS.

closely allied to hysteria, and principally occurs among persons who are desirous of notoriety or sympathy. During the Middle Ages, epidemics of this class were common in Germany: and in Italy they were ascribed to the bite of the tarantula spider. Towards the close of the 14th century, a number of men and women appeared at Aix-la-Chapelle, on the festival of St. John, dancing and screaming in a frantic manner in the streets. Many foamed at the mouth, and danced till they fell down insensible: others dashed their brains out against the walls. While dancing, they were unsusceptible of outward impressions, but were haunted by visions. The epidemic spread over the Low Countries, and bands of wretched ignorant people traversed the country, and, excited by wild music, danced themselves into convulsions, singing all the time in derision of the priests. At the beginning of the 17th century, St. Vitus's dance (*see* CHOREA), as it was then called, was on the decline, and it is now only heard of in isolated cases.

DANDELION. (*See* TARAXACUM.)

DAPHNE, *daf'-ne* (the Greek name of the laurel), a genus of plants belonging to the natural order *Thymelaceæ*. The species are mostly shrubby evergreens of great beauty, with leaves of a peculiar velvet texture, and very fragrant flowers. The root-bark of *D. Mezereum*, the mezeron, or spurge olive, is officinal in the British pharmacopœias. It may be used as a vesicatory, and as a masticatory in toothache; but it is principally employed as a stimulant, diaphoretic, alterative, and diuretic. It owes its properties to an acrid resin and an acrid volatile oil. The stem-bark has similar virtues, but is generally considered to be less active. The fruit is acrid and poisonous. The bark of *D. Laureola*, the spurge laurel, is sometimes substituted for the officinal bark. The inner barks of *D. cannabina* and other species are used in some parts of the world for making paper. *D. Japonica*, recently introduced from Japan is valuable for its lemon scented leaves. Some of the species yield a bitter, astringent, crystalline substance known as *daphinine*.

DARTER, *dar'-ter*, in general form this bird (*Plotus*) resembles the cormorant, but the head is smaller, and supported on a very long and slender neck. The beak is perfectly straight and pointed, with the edges of the mandibles denticulated. Buffon, in allusion to the darter, says, "It offers us a reptile grafted on the body of a bird." It is sometimes called the snake-bird. Its habits while in the water have contributed not a little to its name. It generally swims with its body immerged, especially when apprehensive of danger, its long neck extending above the surface, and vibrating in a peculiar manner. Its long tail, composed of strong and elastic feathers, serves as a rudder when swimming submerged in pursuit of fishes, upon which it principally feeds. It makes a sudden dart at its prey, and from that quick action its name is derived. The darter is found in the warmer parts of the world, in America, and Africa.

DASYURES, *da-se-u'-res* (Gr., *dasus*, hairy; *ouros*, tail). This family includes the largest of the rapacious marsupials, nearly allied to the oppossum, but differing from them in some important particulars. The largest of the species (*Dasyurus ursinus*) measures about eighteen inches long in the body, and is covered with long thick hair, of a black colour. It is a native of Van Diemen's Land, where it is commonly known as "the devil." It is chiefly destructive among sheep, and, despite its small size, is capable of doing immense mischief among the penned flocks. The feet of the dasyures are formed for terrestrial progression; the anterior have five toes, and the hind ones four, all perfectly separate, and armed with curved claws. The dasyures are evidently analogous to the ordinary carnivorous quadrupeds, not only in their ferocity and carnivorous propensities, but also more or less in form.

DATE-PALM AND DATES. (*See* PHŒNIX.)

DATHOLITE, *dath'-o-lite*, a boro-silicate of lime, found in various parts of the world in oblique rhombic prisms. It also occurs in botryoidal or grapeolite forms, when it receives the name of *botryolite*.

DATISCACEÆ, *dai-tis-kai'-se-e*, the *Datisca* family a natural order of dicotyledonous plants in the sub-class *Monochlamydeæ*, consisting of herbs and trees, chiefly natives of the temperate regions of the western hemisphere. The whole order includes but four species, which are widely distributed over the world. The only noteworthy plant is *Datisca cannabina*, the root of which is employed in Cashmere for dyeing yellow.

DATURA, *dat-u'-ra* (from *tatorah*, its Arabian name), a genus of plants belonging to the natural order *Atropaceæ*. The species *D. Stramonium* is the thorn-apple, a plant possessing extraordinary narcotic properties. It is much employed in medicine as an anodyne and antispasmodic, its effects resembling those of belladonna. A strong decoction of the leaves in water is used in Cochin-China as a remedy in hydrophobia, in which terrible disease it is reputed to be very efficacious. *D. Tatula*, *metel*, *ferox*, *fastuosa*, and *sanguinea*, have similar properties to *D. Stramonium*. The fruit of *D. sanguinea*, the red thorn-apple, is used by the Indians of the Andes and of Central America for preparing a narcotic drink which produces a peculiar kind of intoxication, and is supposed to put those who partake of it in comunication with the spirits of their ancestors.

DAUCUS, *daw'-kus* (Greek, *daio*, I make hot), a genus of plants belonging to the natural order *Umbelliferæ*. *D. carota*, variety *sativa*, is the cultivated or garden carrot so much esteemed for its esculent roots. These roots are occasionally used in medicine as a poultice, for their moderately stimulant properties.

DAWALLA, *da-wal'-la*, a fish (*hypophthalmis dawala*) of the *Siluridæ* family about thirty inches long, somewhat resembling a pike in the snout, but with very small teeth. It has no scales, and the colours, green, brown, and crimson are very brilliant. It is a native of Guiana, but is in such favour for the table that it is becoming scarce.

DAY, *dai* (Sax., *dæg*, probably from Lat., *dies*), that period of the earth's revolution on its axis in which its surface is presented to the sun. The term is, however, applied to any astronomical space of time which depends directly on the earth's rotation. But the only days distinguished by that name in astronomy are the sidereal day, the real solar day, and the mean solar day. The sidereal day is the period between the two transits of the same fixed star, that is, a complete revolution of the earth. It is divided into twenty-four hours, and begins when the equinox is on the meridian of the place. The real solar day is the interval between two transits of the sun over the meridian. The length of the real solar day varies at different periods of the year, on account of the unequal motion of the sun and the obliquity of the ecliptic. The mean solar day is the average of all the real solar days. The mean solar time is thus arrived at by imagining a sun moving uniformly in the celestial equator and completing its circuit in the same time as the real sun. The real and mean solar days only coincide in four days of the year. In the intervals the sun is either too fast or too slow. The difference is called the Equation of Time (which *see*). The mean solar day is 24 hours, 3 minutes 56·55 seconds of sidereal time; and the sidereal day is 23 hours 56 minutes 4·09 seconds of a mean solar day. The astronomical day begins at noon, and is divided into twenty-four hours, instead of two parts of twelve hours each. The face of the astronomical clock on the wall of Greenwich observatory is divided into twenty-four hours. Thus, our ordinary 10 o'clock in the morning is with astronomers 22 o'clock. The ancients generally began their day at sunrise, with the exception of the Egyptians, who began at midnight, and the Arabians, who began at noon. The latter nation still retains the same custom; and most of the modern Eastern nations reckon the commencement of the day from sunrise. The Chinese divide the day into twelve parts of two hours each.

DAY-LILY, a genus of plants (*Hemorocallis*) of the natural order *Liliaceæ*. The yellow day-lily (*H. flava*), a native of Siberia, the north of China, and south eastern-Europe, is grown in our gardens on account of its fragrance; and other species are also cultivated by florists. The leaves are excellent food for cattle.

DAY-FLY. (*See* EPHEMERA.)

DEADLY NIGHTSHADE, OR DWALE. (*See* ATROPA.)

DEAF AND DUMB, *def dum* (Sax., *deaf dumb*).—A person is said to be deaf when he is either entirely or in a great measure destitute of the sense of hearing, and dumb when he is without the power of speech or of articulating sounds. Such individuals are also sometimes called deaf mutes. Deafness is either congenital or acquired. When congenital, it arises from an original malformation of the ear, and is always accompanied with dumbness; when acquired, it is the result of some disease affecting some of the delicate parts connected with the organ of hearing. (*See* DEAFNESS, EAR, HEARING.) The ear is necessary to articulation, which is acquired by imitating the sounds we hear uttered by others; and, therefore, if a person is unable to distinguish between articulate sounds, he is incapable of acquiring speech, at least in the ordinary way, and is dumb in consequence of his deafness. It is rare indeed to find dumbness in deaf persons resulting from any imperfection in the organs of speech or from feebleness of mind. What the causes are which produce deafness are as yet but very imperfectly known or understood. There can be no doubt, however, that there exists some connection between the physical conditions of a country and deafness. In mountainous districts it is generally found to be more prevalent than in plain and flat districts, and in rural parts than in cities or towns. A marshy district, or an impure atmosphere, undoubtedly tends to render it more common. The greater number of these unfortunate persons are to be found among the poorer classes; and hence there is reason to believe that the defect is frequently caused by the want of necessary supplies and attention during infancy and childhood. Among the other causes that doubtless tend to produce deafness, are intermarriages among near relations, hereditary predisposition, and certain conditions of life.

DEAFNESS, *def'-ness*, is a considerable or entire loss of the sense of hearing. Hearing is produced by the vibrations of the air striking on the tympanum, or drum of the ear, and is communicated to the auditory nerve by means of a series of small bones, connected in a very remarkable manner. (*See* EAR.) Deafness may be congenital—arising from some original malformation of the organ, or it may result from disease or accident, impairing or destroying some portion of the delicate organism of the ear. It frequently results from some obstruction in the external passage of the ear which interferes with the transmission of sound to the tympanum. This is often occasioned by an unusual accumulation of cerumen, or wax of the ear, which is secreted by the glands of the passage. The most speedy and effectual way of removing this is by syringing the ear with warm water three or four times a day, until it is brought away. Insects and other foreign bodies sometimes lodge in the ear, and occasion deafness; or ulcers or morbid growths may form in the passage, and thus interrupt the transmission of sound. The tympanum may be inflamed, thickened, or injured, to such a degree as to be wholly incapable of performing its office of transmitting sound. Obstruction of the Eustachian tube, which conveys air from the back part of the mouth into the internal cavity of the ear, will often occasion a considerable degree of deafness. Hence, inflammation and other diseases of the throat have frequently this effect. Deafness also sometimes results from derangements in the minute and complicated parts of the organs which are beyond the reach of direct observation, and consequently are but imperfectly understood. The nerve by which impressions are communicated from the internal ear to the brain is also subject to disease, and may occasion deafness, which may also result from diseases of the brain itself. Long exposure to loud deafening noises, a cold, various fevers and inflammations, rheumatism, headache, and repelled cutaneous eruptions, frequently produce deafness. The particular plan of treatment to be pursued will depend upon the nature of the cause, and will necessarily vary considerably in different cases; while the exercise of the greatest attention is often necessary, in order to ascertain the real nature of the case. The diseases that affect the ear are the same as those that affect the other organs, and are to be treated upon the same principles. When they result from inflammation, the inflammation is to be removed in the usual way; when from polypi or morbid growths, these are to be removed by lunar caustic or a surgical operation; when from nervous debility, the general tone of the system is to be strengthened. When an obstruction of the Eustachian tube is the cause of deafness, it is often removed by perforating the tympanum.

When it results from a partial or entire loss of the tympanum, an artificial one may be employed, the best being of vulcanized india-rubber, attached to the end of a fine silver wire, by means of which it may be inserted or withdrawn at pleasure.

DEAL-FISH, a genus of fishes belonging to the Ribbon family, and so called because of their resemblance to a piece of deal. The Vaagmaer, one species of this genus, is a native of the coast of Iceland and Norway.

DEATH, *deth*, in common language, is opposed to life, and is considered as the cessation of it. It supervenes as the necessary termination of all that long succession of phenomena of which life consists. In every part of a living organism there is a continual destruction of old particles and the formation of new ones going on; and, generally, the greater the vital activity of the part the more rapidly do these changes take place. Even the most solid portions of the animal frame are not free from this change, though in them it goes on less rapidly than in the softer tissues. Every movement of the body, nay, even every thought of the mind, is attended with the death and disintegration of a certain amount of muscular or nervous matter as its necessary condition; hence, in the performance of each of those functions whose aggregate makes up the life of man, the particular organ which ministers to that function undergoes a certain loss by the decline and death of its component particles; and this the more rapidly in proportion to the activity of the changes which are effected by their instrumentality. If the regenerative processes be performed with due vigour, no deterioration of the organ takes place; but with the advance of years this regenerative power gradually diminishes, and the entire organism progressively deteriorates, until at last death supervenes. We have thus two kinds of death—molecular, or that which is constantly taking place among the molecular particles of the body, and which is, in fact, essential to its life and well-being; and systemic, which is the death of the body as a whole. Death may result either from the general failure of the vital powers, as in old age, or from some disease or injury in some of the vital organs, which extends itself to the organism in general. It may be due to failure in the propulsive power of the heart, which constitutes *syncope*; and this may occur either in consequence of the heart losing its irritability, and so ceasing to contract, or by being affected by tonic spasms, and so remaining rigidly contracted. In both cases death is instantaneous. Or death may take place by the gradual cessation of the action of the heart; in which case it is termed *asthenia*. Death may also be occasioned by an obstruction to the flow of blood through the capillaries of the lungs, or to the entrance of air to these organs, thus constituting *asphyxia*, or *apnœa*. Death by *coma*, or beginning at the brain, is caused by various influences, which primarily destroy the functions of the superior masses of the nervous system. Death may also be occasioned by a disordered condition of the blood itself, which at the same time weakens the power of the heart, impairs the activity of the nervous system, and prevents the performance of those changes in the capillaries which afford a powerful auxiliary to the circulation. Death may also result from the direct agency of cold stagnating all the vital operations of the system. It is to be borne in mind, that death is frequently produced by a conjunction, or by the rapidly-following results, of two or more of these modes; indeed, the perfect distinction of these different modes of death is almost exclusively confined to cases where the dissolution is speedy or sudden. The signs of approaching death are necessarily various, and depend, in a great measure, upon the nature of the disease. In some cases there is a dulness of the senses, inactivity of the muscles, vacancy of the intellect, and extinction of the sentiments, as in death resulting from old age. There is, also, frequently some degree of delirium. The sense of hearing is frequently also affected, and imaginary voices, and sounds of tolling bells, &c., are heard. *Dementia*, or mental debility, sometimes comes on shortly before death. The voice generally becomes low and weak as death approaches; but sometimes it has a shriller pitch than natural; sometimes it is husky and thick; and not unfrequently it dwindles to a mere whisper. The muscular system generally becomes feeble and relaxed; the pulsations of the heart gradually feebler, but more frequent; the respiration sometimes hurried and panting, sometimes ceasing gradually; and sometimes slow, laborious, and stertoreous. There is frequently, also, an accumulation of fluids—mucous, serous, or purulent, in the bronchial tubes. What is known as the "death-rattle" is produced by the passage of the air from the lungs through the fluid collected in the trachea and upper respiratory passages. The consequences of death first become apparent in the organs of sense and motion; the eye loses its brightness, and the flesh its elasticity; the muscles become stiff, and coldness and paleness spread over the whole body. Yet it is often a very difficult matter to distinguish between real and apparent death. The most reliable test is afforded by the condition of the muscular substance; for after real death this gradually loses its irritability, so that it can be no longer excited to contraction by any kind of stimulation; and this loss of irritability is succeeded by the appearance of cadaveric rigidity. The most satisfactory proof, however, is given by the occurrence of putrefaction, which usually first manifests itself in the blue-green colouration of the cutaneous surface, especially of the abdomen, but which speedily extends to other parts.

DEATH'S-HEAD HAWK-MOTH (*Acherontia atropos*), a lepidopterous insect of the family *Sphingidæ*. It is a species of hawk-moth found in several places in England and in nearly every quarter of the globe. Its length across the wings is nearly five inches; its body is of a yellowish colour, with black stripes; the markings upon the back of the thorax are faint, but bear a close resemblance to a skull or death's-head, from which it derives its name. The wings are dark-coloured, being mottled with yellow, brown, and black. The caterpillar of the death's-head moth is greenish-yellow; the back is covered with black specks, with transverse lines of blue and white. It is often found feeding upon the leaves of potatoes. The moth itself is mostly seen flying during the morning and evening in autumn. As it flies, it utters a low, plaintive sound, and this, together with the death's-head mark upon the thorax, have caused it to be generally regarded with disfavour. How it contrives to make the noise is not known. Another strange property possessed by the death's-head hawk-moth, is that it is able to enter and plunder bee-hives with perfect impunity.

DEATH-WATCH (*Anobium tesselatum*).—The ticking sound which superstitious persons believed to be a sure presage of the death of some person in the house, where it is heard, is now known to be produced by certain beetles belonging to the timber-boring genus *Anobium*. The insect is of a greyish-brown colour, about a quarter of an inch in length, and thick in proportion: the wing-shells are marked with irregular variegations lighter than the ground-colour. The ticking noise is thus produced:—raising itself upon its hind legs, with the body somewhat inclined, it beats its head with great force and agility against the woodwork on which it is standing. The general number of distinct strokes in succession is from seven to eleven. They follow each other quickly, and are repeated at uncertain intervals. The ticking is merely the call of either sex to its mate, and may be considered analogous to the call of birds.

DEBACLE, *de-ba'-kl* (French, breaking up of the ice), a term used by geologists to express a sudden flood of water, which carries forward and scatters masses of débris.

DEBILITY, *de-bil'-e-te* (Lat., *debilitas*, weakness or decay of strength), that departure from the healthy condition of the frame which consists of a diminution of its vital energies—of an enfeebling of its powers, manifested in numerous conditions and grades throughout the whole frame, or more or less remarkably in particular systems or organs. It is intimately connected with the nature of most diseases, and often constitutes disease of itself. Besides the conditions that characterize general debility, there are also specific or partial states of debility, manifesting themselves more particularly in certain of the tissues, organs, or systems; as the circulating or nervous system, the organs of digestion or secretion, the cellular tissues, &c. A particular class of remedies called *tonics* are in general more beneficial than any other, although other articles, as diffusive stimulants and antispasmodics, may often be used with great advantage. Change of air, moderate exercise, agreeable occupation, and pleasant society, are also among the most beneficial means of restoring the depressed or exhausted powers of the frame. Sea-bathing, and in some cases medicated baths, are likewise often of great benefit.

DÉBRIS, *dai-bree'* (Fr.), a French term which has been generally adopted by geologists, and applied to masses of broken rocks, &c. In ordinary conversation, the fragments of any fallen building, such as a house or bridge, are called the débris.

DECAGON, *dek'-a-gon* (Gr., *deka*, ten; *gonia*, angle), a geometrical figure which has ten sides and ten angles. When the sides and angles are all equal, the figure is called a regular decagon, and is inscribable in a circle. An irregular decagon can be formed from a pentagon by describing any irregular triangles upon its sides, so that no two of them shall have their sides in the same straight line.

DECAISNEA, *de-kais'-ne-a*, a plant of the order *Lardizabalaceæ*, a native of the Himalaya mountains. Only one species is known. Several erect stems spring from the root, with leaves, two feet long, standing out horizontally. The fruit resembles a short cucumber, of a yellow colour, full of a milky pulp, sweet and wholesome, and used as an article of food.

DECAY, *de-kai'* (Lat., *decado*, to fall).—The comparatively slow oxidation or burning which moist organic matter undergoes when exposed to air. Substances rich in nitrogen are especially liable to decay; consequently, most animal substances decay more rapidly than any vegetable matter, except the softest and most nitrogenous. The decay of animal substances after death is probably but the continuation of the normal dis-assimilation which goes on throughout life; but as the corresponding processes of repair have ceased, the decay becomes apparent for the first time after death.

DECIDUOUS TREES, *de-sid'-u-us* (Lat., *de*, and *cado*, falling away), trees which annually lose and renew their leaves—the opposite of evergreens. Nearly all the trees and shrubs of temperate regions are deciduous.

DECIMAL FRACTIONS, *des'-i-mal frak'-shuns* (Lat., *decem*, ten), are fractions which have 10, or some power of 10, for their denominator; as one tenth, one hundredth, one thousandth, &c. In ordinary practice, it is often convenient to use decimal fractions, which, for the sake of brevity, are not written out fully. The numerator alone is expressed, with a point on the left-hand side: thus, ·3 represents $\frac{3}{10}$, ·03 represents $\frac{3}{100}$, ·003 represents $\frac{3}{1000}$, &c. Decimal fractions seem to have been introduced about the middle of the 15th century, by Regiomontanus. The first treatise on the subject was written by Stevinus, in his "Practique d'Arithmetique," published in 1582. They are now generally adopted amongst all civilized nations in arithmetical calculations.

DECLINATION, *dek-lin-ai'-shun* (Lat., *declinare*, to incline).—The position of a star in the heavens is determined by its right ascension (*see* ASCENSION, RIGHT) and declination, as the position of any place on the earth's surface is determined by its latitude and longitude. If we suppose a great circle to pass through any star in the heavens and the north and south poles, being consequently perpendicular to the equator, that portion of the circle which lies between the star and the equator, whether it be north or south of that line, is the declination of the star. Declination circles are small circles drawn on the celestial globe parallel to the equator, similar to lines of latitude on the terrestrial globe.

DECLINATION OF THE NEEDLE. After the use of the mariner's compass became general, it was observed that the needle did not invariably point to the geographical north, but was subject to variations. Andrew Bianco, an Italian navigator, specially noted this fact in 1436. Columbus was apparently familiar with the phenomenon, as in 1492 he noted as something remarkable that at about 2° E. of the Azores, there was no variation. In 1604, Gillebrand, an English observer, comparing the results of his investigations with others previously made, noted that, wherever about 50 years before the needle pointed to 11° 15' E., it then pointed to only 4° E. About a hundred years afterwards, the needle pointed to 15° W., and in 1818 the maximum resting position, 24° 4', was reached. Then a retrograde movement set in, and the needle began to travel slowly towards the east. It is now ascertained that it makes an oscillation from its eastern to its western limit, and back again, in about 320 years, the rate of movement being faster as the meridian is approached, and gradually slower towards the limit of the oscillations. The variation is ascertained and measured by an instrument constructed for the purpose, called a declinometer, and by the dipping-needle. (*See* DIP OF THE MAGNETIC NEEDLE.)

DECOMPOSITION, *de-kom-po-zish'-un* (Fr., *décomposer*).—This term is applied, in common parlance, to the separation of the constituents of a substance during putrefaction. In chemistry, it is applied to any process during which a compound body undergoes the separation or re-arrangement of its elements.

Decomposition of Light. (*See* LIGHT.)

Decomposition of Forces. (*See* FORCES.)

DECREPITATION, *de-krep-it-ai'-shun* (Lat., *decrepo*, I crackle), a term applied to the crackling noise, attended with the flying asunder of their parts, made by many minerals and salts when heated.

DECRESCENDO, in Music, the reverse of CRESCENDO (which *see*).

DEDICATION, *ded-e-kai'-shun* (Lat., *dedico*, I inscribe, dedicate), is a complimentary address to a particular person, prefixed by an author to his work. The practice arose from the slight remuneration that in early times was to be derived from literary labour. Hence authors came to be in many cases dependent upon wealthy patrons, to whom they dedicated their works; and hence, too, many authors sought the patronage of a powerful or wealthy individual, by dedicating their works to him. It thus came to be a common practice to acknowledge a dedication with a sum of money. Dedications have in a great measure passed away, and where we still find them they are generally either a token of private friendship or a mark of public esteem.

DEEP SEA SOUNDINGS. (*See* OCEAN.)

DEER, *deer* (Sax., *deor*) (*Cervus*), ruminant quadrupeds, constituting the family *Cervidæ*. The chief characteristics of the deer tribe are, gracefulness of form, fleetness, and neatness and strength of limb; they have a long neck, small head, which is carried high, large full eyes, and large ears; they have no cutting teeth in the upper, but eight in the lower jaw; the males have usually two short canines in the upper, but neither sex has any in the lower jaw. They are distinguished from all other ruminants by their branching antlers, or horns, which in most of the species, exist in the male only. Unlike the horns of the ox, the antlers of the deer are deciduous, falling off every year after the breeding season, and renewed before that exciting period again returns. Each year, until the animal attains old age the horns increase in size both in breadth of palmation and number of branches; when, however, the animal grows so old as to cease to be affected at one season more than another, the horns, although renewed, diminish in size at each renewal. It has been clearly ascertained that the size and development of the antlers are closely connected with the sexual system. The deer's horns are produced by an action analogous to that by which injuries to the bones are repaired. The process forming the base of the horn is covered by a skin, beneath which a sort of inflammation is set up; this produces cartilaginous matter, which increases rapidly in amount, gradually becomes ossified, and finally forms the horn, which, when mature, is still covered with the vascular skin beneath which it has been formed. This, however, dries up and peels off soon after the complete development of the organs, and the latter then consist of bare bone. The growth of the horn is attended by considerable heat and the blood-vessels which supply the head enlarge in size. The species of Cervidæ are very numerous, and dispersed generally through the world, excepting Australia and the South of Africa. Deer are pretty uniformly clothed with hair, longer and thicker on those which inhabit cold than those which inhabit hot climates. Professor Owen thinks that fallow deer are not natives, but were introduced into England at an early period, probably in the Saxon times. The term "fallow" is from the Saxon *falewe*, indicating the yellowish-red or brick-dust colour. The flesh of deer (venison) is considered a great delicacy. Remains of many species of fossil deer have been found in recent geological deposits. The best preserved is the gigantic Irish elk, intermediate between the fallow deer and reindeer. It is found in the later deposits of Ireland, in Scotland, the Isle of Man, and in some of the English bone caverns.

DEERMOUSE, *deer'-mous* (*Meriones*), a genus of American rodent quadrupeds allied to the jerboa. The deermouse, or "jumping mouse" (*Meriones Canadiensis*), is common in Canada. It is about the size of a mouse, with a very long tail, and very long and slender hind legs. It is capable of making leaps of four or five yards. It burrows, and passes the winter in a lethargic state.

DEFICIENT NUMBER, *de-fish'-ent*. A number, the aliquot parts of which, when added together, make a sum less than the number itself. Thus, 8 is a deficient number, the aliquot parts, 1, 2, 4, amounting only to seven.

DEFLAGRATION, *def-la-grai'-shun* (Lat., *de*, concerning; *flagro*, I burn). A term applied to the sudden combustion of substances by throwing them into a red-hot crucible.

DEFLEXION OF RAYS OF LIGHT. (*See* LIGHT.)

DEFORMITY, *de-form'-e-te* (Lat., *deformitas*, from *de*, and *forma*, a form), is the want of that regularity of form necessary to constitute the beauty or symmetry of an object. In the human subject deformities may be either congenital or acquired—*i.e.*, occurring before or after birth. Modern research has shown that congenital deformities are all to be traced to natural causes, which are generally reduced to two main divisions—1, to the original malformation of the germ; or, 2, to the subsequent deformation of the embryo by causes operating upon its development. To the former class are attributed such malformations as are repeatedly produced by the same parents, and hence are in some degree hereditary. Subsequent deformation of the embryo may be produced by various causes affecting its development. A very prevailing opinion is that deformities may be occasioned by strong mental impressions on the mind of the female during pregnancy. Of this, however, there is no satisfactory proof, and it is generally discredited by medical men. Deformities, however, are frequently produced by physical injuries suffered by the mother during pregnancy; and hence a strong mental impression may so affect the mother physically as to transmit its effects to the fœtus. A third cause is attributed to diseases of the ovum and fœtus. A fourth, and assuredly a very general and frequent cause of malformation, consists in impeded development of the fœtus by some remote and unknown cause. The various kinds of artificial deformities will be found treated of under their proper heads.

DEGLUTITION, *deg-loo-tish'-un* (Lat., *deglutitio*, from *deglutio*, I swallow), is the act of swallowing, or the passage of a substance, either solid, liquid, or gaseous, from the mouth to the stomach. Though simple in appearance, deglutition is yet the most complicated of all the muscular actions that serve for digestion. It is effected by the contraction of a great number of muscles and requires the concurrence of many important organs for its accomplishment. It is divided into three stages. In the first, the food passes from the mouth to the pharynx; in the second, it passes the opening of the glottis, that of the nasal organs, and arrives at the œsophagus; and in the third, it passes through this tube and enters the stomach.

DEGREE, IN MATHEMATICS, the circle is divided into 60 equal parts, called degrees; each degree into 60 equal parts, called minutes; each minute into 60 seconds, each second into 60 thirds; and so on. (*See* CIRCLE, TRIGONOMETRY.)

DEGREE, ASTRONOMICAL AND GEOGRAPHICAL.—The imaginary great circles that are supposed to be described on the surface of the earth, and on the apparent surface of the heavens, are similarly divided to aid us in effecting astronomical and geographical calculations, and in determining the position of stars and other celestial bodies on the latter, and the situation of places on the former. These divisions are known as degrees of latitude and longitude, according to the direction in which they are measured. Degrees of latitude are measured from the equator towards the north and south poles, along the meridian, or any great circle in a plane perpendicular to that of the equator. They are numbered, in either direction from the equator, from 0° to 90°. As the earth is not a complete sphere, the length of a degree of latitude is not exactly the same at all parts of the earth's surface, being rather less at the equator than at the poles; for all practical purposes, however, they are assumed to be equal everywhere, having a mean length of 60 geographical miles, or 69·1 English miles, which would be the case if the earth were spherical instead of being an oblate spheroid. The small circles which are supposed to be described on the earth's surface through every degree of latitude, in planes parallel to that of the equator, are called parallels of latitude. Degrees of longitude are measured east and west along the equator, from the meridian of Greenwich on the terrestrial globe, and from the first point of Aries on the celestial globe, and are numbered in either direction from the points that have been indicated from 0° to 180°. Each degree of longitude is 60 geographical miles, or 69·1 English miles at the equator. It will readily be seen, that as the meridians are at 60 geographical miles distance from each other at the equator, and meet in a point at the poles, the degrees of longitude become less and less in length as they are measured along every successive parallel of latitude between the equator and the poles. The following table shows the length of a degree of longitude in English miles measured along every fifth parallel of latitude—the distance at which parallels of latitude are usually inserted in maps of ordinary size.

Deg. of Lat.	English Miles.	Deg. of Lat.	English Miles.	Deg. of Lat.	English Miles.
0	69·1	35	49·1	70	20·5
5	59·8	40	46·0	75	15·5
10	59·1	45	42·4	80	10·4
15	58·0	50	38·6	85	5·2
20	56·4	55	34·4	90	0·0
25	54·4	60	30·0		
30	32·0	65	25·4		

It should be remembered that, in describing the position of a place on the earth's surface, we must mention the latitude as north or south of the equator, and the longitude as east or west of the first meridian. In most countries, geographers assume the meridian of the capital as the first meridian.

DEINACRIDA, *di-na-kri'-da*, a genus of the Cricket tribe, abundant in New Zealand, where it inhabits decaying trees and chink sand crannies in old woodwork. It is carnivorous, and its bite is very severe.

DELIQUESCENCE, *del-e-kwes'-ens* (Lat.), the property possessed by certain substances of absorbing water from the atmosphere and becoming liquid in it. Advantage is taken of this property in the case of chloride of calcium, which is much used by chemists for drying gases, and for promoting the crystallization of other less deliquescent salts.

DELIRIUM, *de-lir'-e-um* (Lat., from *deliro*, I rave or am furious), is a confusion of ideas, which occurs in the progress of certain diseases, from disturbed function of the brain. Sometimes the term is employed to include every form of mental alienation; but generally a distinction is made between insanity and delirium, the latter occurring principally in fever and inflammatory diseases, while the former is unattended by these disorders. (*See* INSANITY.) Delirium may be either violent and frantic (*delirium ferox*), as in acute inflammation of the membranes of the brain, or low and muttering (*typhomania*), as in low fever. It supervenes on fever during any part of its course. It occurs in the hot state of some intermittents, but rarely makes its appearance in typhoid or continued fever until the disease has reached its height.

DELIRIUM TREMENS, DELIRIUM EBRIOSITATIS, OR MANIA A POTU, is a disease of the brain usually caused by an abuse of spirituous liquors, but sometimes also by great mental anxiety and loss of sleep; or it may result from bodily injuries or accidents, loss of blood, &c. Delirium sometimes makes its appearance in consequence of a single debauch; but more frequently it is the result of protracted or long-continued intemperance. It usually supervenes on a fit of intoxication; but it not unfrequently occurs, also, when the habitual drunkard omits his accustomed draught. The predominant emotion with the delirious patient is fear, and in his efforts to escape from an imaginary enemy, he may be guilty of a murderous assault, or, as is more frequently the case, he may take his own life; and hence he requires to be very carefully watched. The delirium continues until the patient sinks into a sleep, from which he awakes comparatively rational, or dies from exhaustion. In such cases death is often sudden. This disease, however, is rarely fatal, unless where the strength of the patient has been seriously impaired by long-continued excesses. This disease is to be carefully distinguished from inflammation of the brain, with which it has many symptoms in common; for bleeding, which is resorted to in the latter disease would be of the utmost danger in this.

DELPHINAPTERA, *del-fin-ap'-te-ra*, a genus of *Cetacea*, of the dolphin family, differing from the Beluga (which *see*) in not having a dorsal fin, and in the snout which is beak-shaped. The most familiar member of the family is the Right Whale Porpoise (*D. Peronii*), abundant in the South Seas. It is about six feet long, black on the back, but white on the belly and snout.

DELPHINIUM, *del-fin'-e-um* a genus of plants belonging to the natural order *Ranunculaceæ*. (*See* LARKSPUR.)

DELPHINIUS. (*See* DOLPHIN.)

DELPHINUS, *del-fi'-nus* (Lat., *delphinus*, the dolphin), one of the constellations described by Aratus, an old Greek astronomer. It is close to the constellation Aquila. Its brightest star is one between the third and fourth magnitude, and it has four of the fourth magnitude.

DELTA, *del'-ta*, the Greek letter Δ.—The lower portion of Egypt, between the eastern and western branches of the Nile and the sea, was, from its resemblance to the letter above, called the Delta. In modern times, whenever a river, before entering the sea, diverges so as to form a triangle, with the sea-line for the base, the alluvial deposit included by the three lines is called a *delta*. The deltas of the Ganges and of the Mississippi are of great size. The existence of a delta at the mouth of a river depends not so much on the amount of sediment held in suspension as on the presence or absence of currents met with at the point of discharge. Deltas are not to be found where there are strong ebb tides; in such case deposit is washed away. But in sheltered bays and gulfs, in the Mediterranean Sea, where there are scarcely any tides, and in inland lakes, deltas almost invariably occur.

DELTOID, *del'-toid*, a muscle of the shoulder, which moves the arm either forward, backward, or upward. It is so called from its resemblance to the Greek letter *delta*. In Botany, the term is applied to a leaf of triangular form.

DEMENTIA. (*See* INSANITY.)

DEMOISELLE, *dem'-o-sel*. (*See* CRANE.)

DEMULCENTS, *de-mul'-sents* (Lat., *demulceo*, I soften), a name given to such medicines as are especially useful in obviating the action of acrid and stimulating matters, and that not so much by correcting or changing their nature as by involving them in a mild and viscid fluid, which prevents their acting, or by covering the surface exposed to their influence. They are generally divided into two classes—mucilages and expressed oils; and are principally used in catarrh, diarrhœa, dysentery, gravel, and a few other complaints.

DENDRERPETON, *den-drer'-pe-ton* (Gr., *dendronata*), the name given to a lizard-like batrachian, between two and three feet long, the bones of which were found in Nova Scotia in a fossil tree. Professor Owen showed it to be nearly related to Archegosaurus. (*See* ARCHEGOSAURUS.)

DENDRITE, *den'-drite*, a mineral crystal having the appearance of moss found on rocks, especially limestone and trachyte. It is generally composed of hydrous oxide of manganese.

DENDROLEGUS, *den-drol'-e-gus* (Gr., *dendron*, tree; *lego*, I choose), a genus of Marsupialian animals belonging to the Kangaroo family. They, however, differ considerably from the rest by their adaptation to an arboreal life. The size of the animals belonging to this family differs considerably, some of them measuring more than four feet in length, independent of the sweeping tail; while others (*see* KANGAROO RAT) are no larger than a small rabbit. The tree kangaroos are found rather plentifully in New Guinea.

DENDROLITES, *den'-dro-lites* (Gr., *dendron*, tree; *lithos*, stone), petrified stems of trees and plants found in the secondary formations, and especially in the coal strata. These remains are found in very different sizes, some being gigantic. Sometimes they are found with fossil branches, fruit, and even leaves; but in general, they are only found in fragments. The wood from which dendrolites originally were formed mostly belongs to the Filices, the Cycadeæ, and the Coniferæ; and it is generally converted into agate or pitch-stones. There is considerable doubt as to their origin, and some of them are so hard that they are cut and used for artistic purposes. When cut into very thin plates and examined under the microscope, they show the structure of the wood perfectly, and it is possible for the botanist not only to name the order or family, but to specify the genus and species of plants to which it belongs.

DENDROPHIS, *den'-dro-fis* (Greek, tree-snake), a genus of serpents of the *Colubridæ* family, mostly living among branches of trees. They are very slender and lively, with prominent eyes, and are beautifully coloured. They are natives of tropical regions.

DENDROSAURA, OR TREE-LIZARDS, *den-dro-saw'-ra* (Gr., *dendron*, tree; *sauros*, lizard), the term applied to a genus of reptiles of which the chameleon may be regarded as the type.

DENGUE, OR BREAK-BONE FEVER, *deng(r)*, is the name of a disease that has, on several occasions, recently made its appearance in the southern states of North America and the East and West Indies, and is characterised as a severe inflammatory fever, accompanied with rheumatic pains in the joints and muscles. Though very severe, it is not often fatal, and usually terminates in a few days with a copious discharge of perspiration.

DENSITY, *den'-si-te* (Lat., *densitas*), a term which has exactly the same practical meaning as specific gravity. If two substances are of equal bulk, but one contains more matter than the other, it is said to have more density. The quantity of matter is measured by the weight; and thus specific gravity and density become proportional. Rarity is opposed to density, and the rarest body known is hydrogen, and the densest body iridium, which is upwards of forty times the weight of water.

DENTINE, *den'-tine*, the enamel which coats the teeth of mammalian animals. It consists mainly of phosphate of lime and gelatine.

DENTIROSTRES, *den-te-ros'-trees* (Lat., *dens*, tooth; *rostrum*, beak), a sub-order of birds of the order *Insessores* of predatory habits, and distinguished by the upper mandible being notched on either side. The butcher-bird belongs to this order. (*See* BUTCHER-BIRD.)

DENTITION, *den-tish'-un* (Lat., *dentitio*), is the breeding or cutting of the teeth, which takes place soon after birth, and is frequently attended with various disorders. At birth the teeth consist only of pulpy rudimentary substances, buried in the gum; and it is not till the third or fourth month after birth that they begin to assume shape and hardness. At this period children become uneasy and fretful; the gum is red and swollen, accompanied with a feeling of itching, which is manifested by the eagerness with which they press any hard substance against the gums. The salivary glands sympathize with the gums, and their is a copious discharge of saliva. Frequently these symptoms of local irritation are accompanied by others of a more constitutional nature. The skin becomes dry and hot, the face flushed, the bowels relaxed, and the child very restless and fretful. A red rash usually also appears on the skin, called the *red gum;* and if the irritation extends to the muscles of the chest, there is a dry and troublesome cough. When the infant is in a tolerably healthy state, these symptoms usually subside in the course of two or three weeks; but if it be in a weakly condition, they frequently lead to serious and sometimes fatal results. The mucous membrane which lines the stomach and intestines may be affected from that of the mouth, and griping pains, nausea, vomiting, diarrhœa, and other disorders, may be the result. The external skin sympathizing with the internal covering, may be affected with various kinds of eruptions; the air-passages and lungs may also become inflamed, or the brain and nervous system may become diseased, producing convulsions, epilepsy, tetanus, &c. The cutting of the teeth usually takes place between the seventh and ninth month, though sometimes it is much later. The gum again becomes extremely sensitive; but, instead of now being eased by the pressure of a hard substance, it cannot endure the slightest touch. It is red and swollen, but paler at the upper part, which, just before the tooth appears, seems covered with a flat whitish blister. The other symptoms are a repetition of those already described, with frequently eruptions about the head or lips, inflammation about the ears, and occasionally spasmodic movements of the mouth and jaws. These diseases are not always confined to the period of infancy; for in irritable and nervous constitutions they sometimes manifest themselves (though usually in a less aggravated form) at the irruption of the second or permanent teeth, and even occasionally when the *dentes sapientiæ* are about to make their appearance. The period of dentition in children cannot be too scrupulously watched over; for there are few diseases that require more prompt treatment than some that then make their appearance; and, if not of themselves fatal, they often lead to serious or fatal disorders.

DENUDATION, *de-nu-da'-shun*, removal of solid matter by the action of water. (*See* GEOLOGY.)

DEOBSTRUENTS, *de-ob'-stru-ents* (Lat., *de*, and *obstruo*, I obstruct), such medicines as have the property of removing obstructions in any part of the body, especially in the lymphatic system. They were formerly much used and depended upon in medical practice; but latterly they have fallen into disuse. Almost the only deobstruents now employed are mercury, iodine, and bromine.

DEPHAL, *de'-fal*, a tree (*Artocarpus lakoocha*) of the same genus as the bread-fruit tree, a native of the south of India, and yielding edible fruit. The timber is valuable, and from the root a yellow dye is extracted.

DEPHLOGISTICATED, *de-flo-jis'-te-kai-ted*, a term sometimes used to denote bodies which had been burnt or deprived of their phlogiston. (*See* PHLOGISTON.)

DEPOSITS, *de-poz'-its*, in Geology, those rocks which have been formed by the settling down of matter held in suspension in water. Deposits originate in denudation, the forming of alluvium, and the gradual collection of sand, gravel, &c., at the mouths of rivers. (*See* DELTA.) Deposits are called marine, lacustrine, fluviatile, &c., according to the circumstances which attended their formation.

DEPRESSION OF THE HORIZON. (*See* DIP.)

DERBYSHIRE SPAR, *der'-be-sheer.*—Fluor spar, or fluoride of calcium, is popularly known by this name, from the finest being found at the Blue John mine, in Derbyshire.

DERIVATION, *der-iv-ai'-shun* (Lat., *derivatio*, from *derivo*, I drain off), in Medicine, is applied to the removing or drawing away of a disease from its original seat to another part by artificial means; as by the application of a blister.

In Grammar. (*See* ETYMOLOGY.)

DERMATOLOGY, *der-ma-tol'-o-je* (Gr., *derma*, the skin, and *logos*, a discourse), is the science of the treatment of the skin and its diseases.

DERMATOPHYTES, *der-mat'-o-fites* (Greek, *phyton*, a growth or plant), vegetable growths formed in the skin, and giving rise to some forms of skin disease, as ringworm, &c.

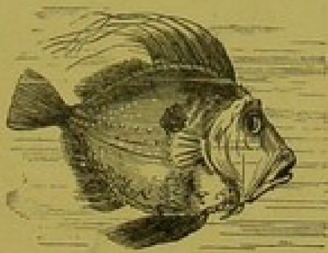
DERMESTIDÆ, *der-mes'-ti-de* (Gr., *derma*, *esthio*, I eat), small beetles of a very destructive character. A well-known specimen of the dermestes is *D. dararius*, or bacon-beetle, a name applied through the insect's real or supposed fondness for bacon. It is about a third of an inch in length, and of a dusky brown colour, with the upper half of the wing-shells ash-coloured, and marked with black spots. The larvæ of other species abound in cargoes of hides brought from hot climates, and in long-kept stores of ship-biscuits.

DERMIS. (*See* SKIN.)

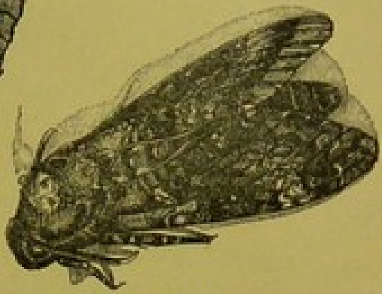
DERMOPTEROUS, *der-mop'-ter-us*, a name taken from the Greek for skin-finned, given to an order of fishes, having cutaneous vertical

DEER (FALLOW).

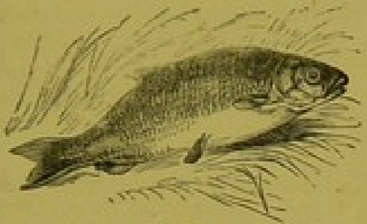
DRAGON FLY.



DOREY.



DEATH'S-HEAD MOTH.



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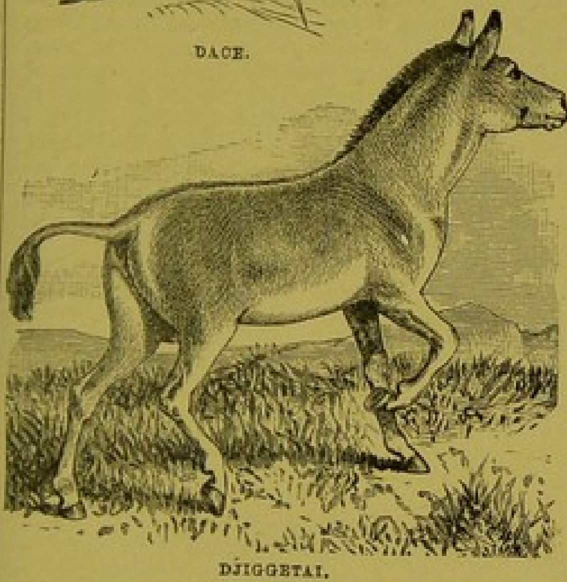

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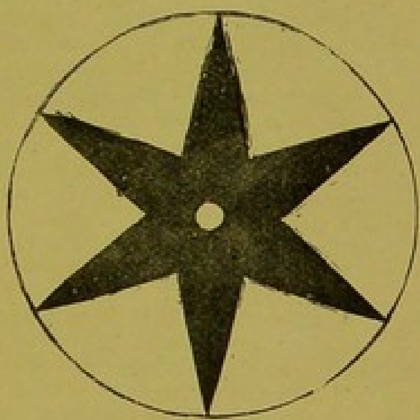

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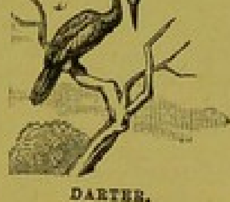

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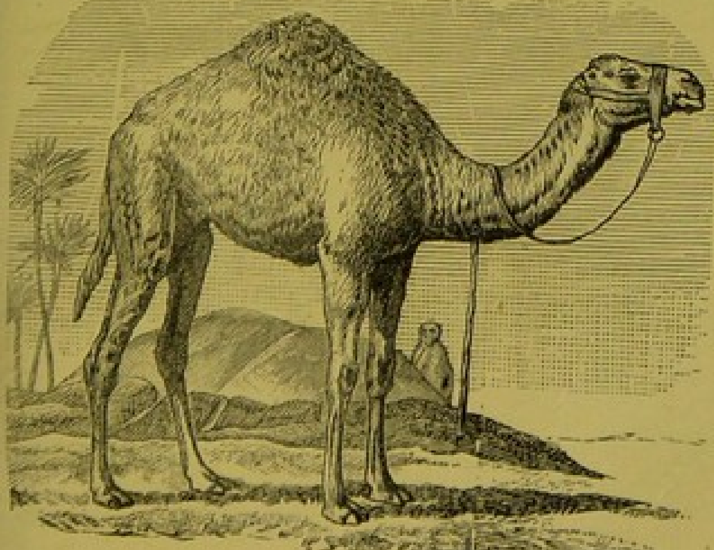


DROMEDARY.

DATE-PALM.

fins, with very soft and delicate rays, and without pectoral and ventral fins. Lampreys and lancelets belong to this order.

DESCENT, *de-sent'*, in Mechanics, the Line of Swiftest Descent is that by which, under the action of force of gravity, passes most quickly from one point to another.

DESERT, *dez'-ert* (Lat., *desertus*, deserted, solitary), a waste or large tract of barren country. The term is applied very vaguely, but is more particularly appropriated to sandy and stony plains. Deserts are distinguished by different names in various parts of the earth. The term desert is more particularly applied to the waste tracts of Africa and Arabia. Those in Asia, especially in Thibet and Tartary, are called steppes. In South America, the large plains, rank with vegetation, but unfit for human settlements, are called llanos, pampas, and silvas, or desert-forests. The wide-stretching plains of North America are called prairies and savannahs. The desert of Sahara is the most famous of the properly so-called deserts. It stretches almost without a break from Cape Nun, on the north-west coast of Africa, eastward to the banks of the Nile, the eastern portion being generally known as the Desert of Libya. In some parts of this desert, as at Tegazza, rock-salt as white as snow extends in vast beds beneath a stratum of rock. Here and there, often at great distances, are a few small fertile spots, called *oases*, which serve as resting-places for the merchants, who travel on camels, hence called "the ships of the desert." To the east of the red sea, in Arabia, and stretching to Tartary, are extensive deserts, the most extensive being the desert of Gola, extending in a north-eastern direction from the western extremity of Thibet. The sand of the desert is not always a proof that at some former time the desert was the bed of an inland sea. It is frequently of local origin, formed from the soil of the desert plain by sudden changes of temperature and the action of the wind, and is formed from the underlying sandstone, quartz, salt, and gypsum.

DESSICANTS, *de-sik'-kants.*—In Medicine, substances with astringent properties, employed to check secretion and exhalation.

DESMIDIEÆ, *des-mi-dé-e*, a group of minute Algæ, of very low organization, appearing to connect the animal and vegetable kingdoms, resembling in some respects the *Diatomaceæ*, but having rounded instead of angular forms, the absence of silicious covering and their green colour. (*See* DIATOMACEÆ.)

DESMODIUM, *des-mo'-de-um* (Gr., *desmos*, a bond, in allusion to the stamens being joined), a genus of plants belonging to the natural order *Leguminosæ*. Some of the tropical species are remarkable for the periodical movements of their leaflets under the influence of light.

DESMONCUS, *des-mon'-kus*, a genus of palms, with slender stems climbing over shrubs and trees. There are many species, all natives of America.

DESVAUXIACEÆ, *dai-voze-e-ai'-se-e*, the Bristlewort family, a natural order of monocotyledonous plants, in the sub-class *Petaloideæ*. They are small, sedge-like herbs, with setaceous sheathing leaves, and are natives of Australia and the South Sea Islands.

DETERGENTS, *de-ter'-jents* (Lat., *detergo*, I wipe away), is a name given to such medicines as cleanse and remove viscid humours adhering to and obstructing the vessels; also such applications as cleanse foul ulcers.

DETRITUS, *de-tri'-tus*, in Geology, accumulations formed by the disintegration of rocks, consisting of gravel, sand, or clay, or an admixture of them.

DEUTEROPATHIC, *du'-te-ro-path'-ik* (Gr., *deuteros*, second, and *pathos*, suffering), an affection induced in a part through sympathy with the part originally affected; as where the stomach is disturbed through a wound in the head.

DEUTOXIDE, the oxide of a metal containing a double amount of oxygen. The word *binoxide* is, however, more generally used; and this remark applies to all compounds commencing with the word *deuto*.

DEUTZIA, *de-ut'-ze-a*, a genus of plants belonging to the natural order *Philadelphaceæ*, natives of the north of India, China, and Japan; and cultivated here generally as greenhouse plants, for the profusion and beauty of their white flowers. The leaves of some species, especially those of *D. scabra*, are covered with silicious fibres; hence, from their roughness, they are used in Japan for polishing purposes.

DEVELOPMENT. (*See* PHYSIOLOGY.)

DEVELOPMENT THEORY. (*See* EVOLUTION.)

DEVONIAN SYSTEM. (*See* OLD RED SANDSTONE.)

DEW, *dew* (Sax., *deaw*), the moisture or aqueous vapour which is deposited from the air on those bodies which are exposed to it. It is generally observed in the form of minute globules on the surfaces of leaves. When the cold is extreme, it takes a solid form, and appears as hoar-frost. When the atmosphere is at any given temperature and pressure, it holds a proportionate quantity of aqueous vapour in suspension. If that temperature is lowered to a certain point, called the dew-point, a quantity of aqueous vapour is set free in the form of water or dew, which can sometimes be seen falling as a fine rain or mist. Those substances which radiate heat rapidly are cooled soonest; and therefore the dew is deposited upon them first. All vegetable fibres are ready radiators of heat; consequently, the smooth leaves of trees, shrubs, and grasses cause the dew to be deposited upon them even upon moderately warm evenings. Radiation takes place most rapidly when there is a clear sky: when there are many clouds in the air, heat is radiated back by them to the earth, which nearly supplies the amount of heat lost. Thus dew is more readily deposited upon clear fine nights than when the sky is overcast. Hoar-frost is frozen dew.

DEWBERRY, *dew-ber'-re*, a plant (*Rubus cæsius*), of the same genus with the bramble. The name is taken from the dew-like bloom, of a bluish colour which covers the fruit. The fruit is of agreeable flavour. It is common in many parts of Europe and Asia. In Canada, the dewberry (*R. procumbens*) yields a much finer fruit than the English variety.

DEXTRIN, *deks'-trin*, a transparent brittle solid, with a vitreous fracture, formed by submitting starch to a heat of 400° Fah. Dextrin is a modification of starch, possessing the same composition, but different properties. It is, for instance, soluble in cold water, a property which renders it particularly valuable for manufacturing purposes, under the name of *British gum* (which *see*). It has received the name of *dextrin* from causing the rotation of a polarized ray from left to right. It may be always distinguished from starch by its pale buff colour, by not giving a blue colour with iodine, and from being insoluble in alcohol; and from gum, by giving a blue solution with potash and sulphate of copper.

DHOLE, *dole*, a wild dog of India (*Canis scylax*), found in the Western Ghauts and other mountainous districts. It is smaller than a wolf, which it in some respects resembles, but has longer legs and a straight, not bushy, tail. They are fierce, of great courage, and are especially dreaded by animals of the feline race. The name is sometimes extended to varieties of wild dogs in Nepaul, Ceylon, and other places in Asia.

DIABETES, *di-a-be'-tees* (Gr., *dia*, through, and *bainomai*, I pass), a disease characterized by an inordinate flow of urine. Medical men recognise two distinct kinds of diabetes—the *diabetes insipidus*, in which there is merely a greatly-increased flow of urine, accompanied by almost incessant thirst; and *diabetes mellitus*, in which the urine is found to contain a large quantity of saccharine matter. Persons of a debilitated constitution, and in the decline of life, are most subject to this disease. It commonly comes on slowly and imperceptibly, without any apparent disorder of the system, and may exist for a considerable time before it attracts any notice. One of the most constant symptoms of this disease is an inordinate degree of thirst; and yet the quantity of urine passed daily is usually much greater than that of the liquids drunk. A voracious appetite is also a usual characteristic of this disease. At length the constitution manifestly suffers, the body becomes emaciated, the strength and vigour fail, the pulse is frequent and small, a slight degree of fever prevails, and the skin is dry and rough. There are also usually aching pains in the back and loins, and uneasy sensations along the urinary passages. The symptoms gradually become more and more intense, until at length the patient sinks from exhaustion, or is cut off by dropsy, consumption, or some other incurable disease. Of the causes of this disease, unfortunately, little is known. The measures resorted to in its treatment are rather of a palliative than a remedial nature. It is possible, by judicious treatment, to greatly mitigate the symptoms, and to ward off the issue for a number of years. The treatment should be principally directed to restoring and strengthening the tone of the system, by abundant exercise in the open air, and the use of tonics and such medicines as tend to soothe the nervous system. The state of the skin is particularly to be attended to; and daily ablution of the whole body in warm or cold water is recommended. Flannel should also be worn next the skin. Those kinds of food that contain sugar, or matter easily convertible into sugar (*see* GRAPE-SUGAR) are to be as much as possible avoided.

DIAGNOSIS, *di-ag-no'-sis* (Gr., *diagignosko*, I discern or distinguish), is the art of discovering the nature of a disease, and of distinguishing it from other diseases of a similar nature. Much depends upon a correct diagnosis of disease; and the minute characteristics that frequently distinguish one disease from another render it often a matter of great skill and delicacy.

DIAGONAL, *di-ag'-o-nal* (Gr., *dia*, through; *gonia*, an angle), a straight line drawn from any angle to an opposite one in a rectilineal figure. A straight line drawn between two adjacent angles would obviously coincide with the boundary-line; consequently no triangle can have a diagonal. A quadrilateral figure has two diagonals, a pentagone five, a hexagon nine, &c. In order to calculate the number of possible diagonals in a given figure, the plan is to take three from the number of sides, multiply the remainder by the number of sides, and take half the product.

DIALIUM, *di-ai'-le-um*, a genus of leguminous plants. The only remarkable species *D. indicum*, which yields a fruit called the tamarind plum, the pulp of which has an agreeable slightly acidulous taste, somewhat resembling that of the common tamarind.

DIALLAGE, *di'-al-laj* (Gr., *diallege*, difference), a foliated silicio-magnesian mineral, so called from its changeable colour, and nearly allied to angite. A beautiful green diallage (smaragdite) found in southern Europe, India, and Labrador is valuable for ornamental purposes.

DIALLOGITE, *di-al'-lo-jite*, a carbonate of manganese occurring in crystalline masses of a rose-red colour. It is found chiefly in gneiss and porphyry veins, with silver, lead, zinc, and other ores, in Saxony and Transylvania.

DIAMAGNETISM, the property possessed by some substances of being repelled, not attracted, by a magnet. (*See* MAGNETISM.) Among the most familiar diamagnetic substances are alum, antimony, arsenic, bismuth, cadmium, carbonic acid, copper, glass, gold, lead, mercury, phosphorous, resin, and sulphur.

DIAMETER, *di-am'-e-ter* (Gr., *dia*, through; *metron*, a measure), a term generally applied to the line drawn through the centre of a circle, and bounded at either end by the circumference. Whenever any point is called a centre, any straight line drawn through that point is generally called the diameter.

DIAMOND, *di'-a-mond*, the word diamond is derived from the Greek *adamas*, unconquered, in allusion to its extreme hardness. Chemically speaking, diamond is pure crystallized carbon. As found in nature, diamonds occur crystallized in forms belonging to the regular system. The crystals are mostly derived from the octahedron; but the faces are frequently convex, and the edges rounded. In their rough state they present the appearance of semi-transparent rounded pebbles, covered with a thin brownish opaque crust. Freed from this coating, they are generally colourless; but they are also found tinged with red, orange, yellow, brown, and black. The pure white transparent variety are most highly prized, and are called diamonds of the first water. The finest diamonds occur in quartzose alluvial deposits at Golconda and Bundelcund, in India where the finest specimens have been found; also, in Borneo, in several districts in Brazil, in the Ural mountains, in Russia, and in one or two other localities. The origin of the diamond in nature is at present unknown. It is, however, evidently of vegetable origin. In 1879 and 1880, Mr. MacTear and Mr. J. B. Hannay, both of Glasgow, thought they had discovered a method of producing real diamonds by artificial means, but close scientific examination proves they had been unsuccessful. Diamonds are valued at so much per carat of four grains, and increase in price in a given proportion. The general rule for finding the value of cut diamonds, is to square the weight in carats, and multiply by £2. This rule does not apply to diamonds weighing more than 20 carats. Flaws in diamonds are often cut out by cleavage through the natural planes of the crystal. Diamonds are inflammable when heated red-hot, and plunged into an atmosphere of oxygen, burning with a steady light, and giving rise to pure carbonic acid. They are not, however, perfectly pure, a small residue being left behind, containing silica and iron. The specific gravity of diamond is about 3·6.

DIAMOND BEETLE, a name usually given to *Curculio imperialis*, a species of the tribe *Curculionidæ* (weevils), and order *Coleoptera*, found abundantly in Brazil. It is polished black in colour, the head, thorax, and limbs being slightly granulated and covered with metallic green scales, and the wing-cases (*elytra*) studded with regular lines of concavities, each depression thickly lined with bright green scales, so that the rays of light are reflected and heightened by the contrast of the shining black interstices.

DIANTHUS, *di-an'-thus* (Gr., *anthos*, flower; *dios*, of Jupiter—the divine flower), a genus of plants belonging to the natural order *Caryophyllaceæ*. Many of the species are highly valued for the beauty and the fragrance of their flowers. *D. barbatus*, the sweet-william, is an old inhabitant of the flower-garden, and was much esteemed in Gerard's time "for its beauty to deck up the bosoms of the beautiful, and garlands and crowns of pleasure." The flowers grow in fascicles, and are usually of a fine crimson colour. There are numerous varieties in cultivation. The species *D. caryophyllus*, which grows wild on old walls in the south of England, is supposed to be the source of the garden carnations, and, by some botanists, of the pinks also. The carnation has been cultivated from time immemorial in Europe, and its beauty and rich spicy odour make it a general favourite. It is the principal florist's flower of Germany and Italy, from which countries we derive the choicest varieties. The varieties of the carnation are arranged in three classes—*flakes*, *bizarres*, and *picotees*. Flakes have two colours only, the stripes being large; bizarres (Fr., odd or irregular) are variegated in irregular spots and stripes, with no less than three colours; picotees (Fr., *piquettée*, pricked or spotted) have a white ground spotted or pounced with red, purple, or other colours. The garden *cloves* have petals of a deep scarlet colour, and are derived, like the varieties of the carnation, from *D. caryophyllus*. The pink, as a florist's flower, received but little attention until the close of the last century, but many fine varieties have been developed since then. New varieties of the carnation and pink are procured from seeds, and thousands of seedlings are annually raised by florists and amateurs. Established or approved varieties are continued by layering and by cuttings, or, as they are commonly called, *pipings*. The soil in which they thrive best is a rich loam, rather sandy than otherwise.

DIAPENSIACEÆ, *di-ap-en-se-ai'-se-e* (Gr., *dia*, through; *pente*, five; in allusion to their being five-cleft), a small natural order of dicotyledonous shrubby plants in the sub-class *Corollifloræ*. There are but two genera and two species, natives of North America and northern Europe.

DIAPHANOUS BODIES. (*See* LIGHT.)

DIAPHORETICS, *di-a-fo-ret'-iks* (Gr., *diaphoreo*, I carry through), a name given to medicines that increase the natural exhalation of the skin. When they are so powerful as to produce actual perspiration they are called sudorifics, the difference between the two classes being only one of degree, not of kind. They are in general used to restore the cutaneous discharge when it has been suppressed through cold, and are hence useful in catarrh, rheumatism, or diarrhœa proceeding from cold. Among the more common diaphoretics are antimony, ipecacuanha, ammonia, opium, guiacum, camphor, and contrayerva.

DIAPHRAGM, *di'-a-fram* (Gr., *diaphragma*, a partition), the transverse muscle which separates the thorax or chest from the abdomen or belly. It is usually described as consisting of two muscles. The superior and larger of these arises from the cartilage of the sternum, and the ends of the lower ribs on each side; from which points the fibres converge, and terminate in a tendon, or aponeurosis, termed the *centrum tendinosum*, or central tendon. The second and inferior muscle springs from the vertebræ of the loins by two productions, or crura; that on the right side from the four upper lumbar vertebræ, that on the left from the three upper ones. From these points the fibres ascend, some of them crossing over and decussating to surround the œsophageal opening; but all of them ultimately uniting with the central tendon, and thus making but one muscular partition. The diaphragm is convex superiorly and concave inferiorly, and is covered on its upper side by the pleura, and on the lower by the peritoneum. In form it is nearly circular, and is fleshy at the edges, but becomes tendinous towards the centre. It presents three large openings and several smaller ones. The opening of the vena cava is quadrangular in form, and is situated in the tendinous centre. The œsophagal opening is posterior to that of the vena cava, and is of an elliptic form. The aortic opening is the most posterior, triangular, and between the crura. This muscle is the principle agent in respiration; for by contracting it enlarges the cavity of the chest, and allows the lungs to receive the air in inspiration, while by being relaxed, the cavity of the chest is again diminished, and the air suddenly expelled. Whatever occasions stoppage of the action of this muscle speedily proves fatal. It is subject to inflammation, called *diaphragmatitis*; but as this is rarely confined to the organ itself, but communicated either to the pleura or peritoneum, its symptoms and mode of treatment correspond with inflammation of these parts. (*See* PLEURITIS and PERITONITIS.)

DIARRHŒA, *di-ar-re'-a* (Gr., *dia*, and *rheo*, I flow), is a disease characterised by an increased discharge from the bowels, usually in a very liquid state, and sometimes containing a large quantity of bile. This disease may be occasioned by anything that stimulates or irritates the mucous surface of any portion of the alimentary canal. Besides the various purgative medicines, undressed or indigestible foods or vegetables, acid fruits, oily or putrid substances, frequently cause diarrhœa. Suppressed perspiration, occasioned by a sudden chill or cold applied to the body, or a draught of any cold liquid when overheated, may produce it. It is more apt to occur during the summer and autumn months than at any other period of the year. The effluvia arising from the decomposition of organic substances is a frequent cause of it. This is one of those diseases by means of which nature strives to get rid of impurities, and restore the system to its normal condition. Hence, when it is not very violent, and when the patient is strong, it is best to allow it to run its course, at all events for a time, and even to aid it by small doses of laxatives. In any case, great care is to be taken not to stop it too suddenly.

DIASTASE, *di'-as-taze* (Gr., *diastasis*, a separating of parts), a peculiar ferment found in all germinating seeds. It is this principle which causes the starch in malt to be converted first into dextrin and then into sugar. When barley is malted, diastase is developed in the grain, which converts the starch into sugar, on the application of heat and water in the operation of mashing.

DIASTOLE, *di'-as-tole* (Gr., *dia*, and *stello*, I stretch), a term applied to the dilatation of the heart and arteries, and opposed to systole, the contraction of these parts.

DIATHERMANCY, *di-a-ther'-man-se* (Greek, *dia*, through, and *therma*, heat), permeability to the rays of heat. Diathermanous bodies have the same relation to calorific rays that transparent ones have to rays of light; and these bodies which are impermeable to rays of heat, or bear the same relation to it that opaque ones do to light, are called athermanous.

DIATHESIS, *di-ath'-e-sis* (Gr., *diatithemi*, I dispose), a certain state of body predisposing it to certain diseases. Thus the scrofulous or gouty or cancerous diathesis denotes a certain constitution of body leading, under certain favourable conditions or exciting causes, to these diseases.

DIATOMACEÆ, OR DIATOMS, *di-at-om-ai'-se-e, di'-at-oms* (Gr., *dia*, across; *tome*, cut), the Brittleworts, a family of confervoid algæ, of very peculiar character, consisting of microscopic brittle organisms, found in almost all fresh, brackish, or salt water, sometimes forming a uniform yellowish-brown layer at the bottom of the water, at others adhering to various water-plants, decaying stems, and stones, or scattered between the filaments of *Confervæ*. They also occur among mosses and *Oscillatoriæ*, and on damp ground. The individual cells of the *Diatomaceæ* are called *frustules* or *testules*,, and are furnished with an external coat of silica. This flinty coat, of two usually symmetrical portions or valves, is comparable with those of a bivalve shell, but is in contact, at its margins, with an intermediate piece called the hoop, which varies in breadth according to age. The separate valves are of various forms. Fossil diatomaceæ are found in strata of every age.

DIBRANCHIATES, *di-brank-i'-a-tes*, a division of cephalopod molluscs, having two gills or branchiæ, an outer gland, and, with few exceptions, a rudimentary internal shell. The division includes the argonaut, cuttle-fish, octopus, squid, and spirula among living forms, and the extinct balemnites.

DICHLAMYDEOUS, *dik-lam-i'-de-ous* (Gr., *dis*, twice, and *chlamys*, a covering), a term applied to flowers which have both a calyx and a corona.

DICLINOUS, *di-kli'-nous* (Gr., *dis*, twice, and *kline*, a bed), a botanical term implying that flowers are uni-sexual, having stamens or petals only, and opposed to *monoclinus* or *hermaphrodite*.

DICHOTOMOUS, *di-kot'-o-mous*, a term used in botany to designate branching by repeated forkings, as in the veins of the fronds of ferns and the leaves of some coniferous trees.

DICHROISM, *di'-kro-ism* (Gr., *dis*, twice; *chroma*, a colour), the property possessed by many doubly-refracting crystals of exhibiting different colours when viewed in different directions.

DICOTYLEDONES, *di-ko-til-e'-dones* (Gr., *dis*, two; *kotuledon*, a cavity), one of the two great classes into which flowering plants are divided. It agrees with the *Exogenæ* of some botanists, and with the *Exogens Gymnogens* of Lindley. (*See* BOTANY.) The name *Dicotyledones* is derived from the condition of the embryo prevailing throughout the vast majority of plants included in the class: but, as in all other natural groups, instances occur wherein the particular character which has suggested the name is absent. In these exceptional cases, however, the plants agree with the rest in other prominent characters, as the structure of the stem, and the plan of the flower. The presence of a pair of cotyledons in the embryo must not, therefore, be regarded as an essential character of the *Dicotyledones*, though it is presented by most of the plants in this great natural group.

DICRANUM, *di'-kra-num*. (*See* MOSSES.)

DICTAMNUS, *dik'-tam-nus* (from *Dicte*, a mountain of Crete, where it grew), a genus of plants belonging to the natural order *Rutaceæ*, including two species, which are commonly cultivated in gardens for the sake of their handsome flowers. Of these, the more remarkable is *D. fraxinella*, so named in allusion to the similarity which exists between its leaves and those of *Fraxinus*, the ash. Its root was formerly much used in medicine, but it is now rarely, if ever, employed. The plant is commonly called the false dittany.

DICYNODON, *di-sin'-o-don*, a genus of fossil reptiles, remains of which have been found in South America. It has affinities with the tortoise, and also with the crocodile and the lizard, and is remarkable as possessing two sharp-pointed tusks, growing downwards as in the walrus.

DIDYMIUM, *did'-e-me-um* (Gr., *didumos*, twin), a very rare metal, closely allied to cerium, and occurring with it in its ores. It forms one oxide, which has the properties of an earth.

DIELYTRA, *di-e-li'-tra*, a genus of plants of the natural order *Fumariaceæ*, larger than the ordinary fumitories. *D. spectabilis*, a favourite flower of Northern China, was introduced into Britain in 1846, and is cultivated on account of the beauty of its large racemes of drooping pink flowers. It is now a common flower in open gardens.

DIET. (*See* FOOD.)

DIETETICS, *di-et-et'-iks* (Gr. *diaitetike*), that department of medical science which relates to the diet or ordinary food. (*See* FOOD.)

DIFFERENTIAL CALCULUS, *dif-fer-en'-shal* (Lat., *differo*, I move apart), a term applied to one of the most important branches of the higher mathematics. The object of the differential calculus is to find the ratios of the differences of variable magnitudes, on the supposition that these differences become infinitely small. In this study it is necessary to pay particular attention to the meaning of the terms infinitely and infinitely small. All magnitudes in mathematical reasoning are considered to be capable of augmentation and diminution without limit. A quantity, therefore, can be conceived to be so great as to exceed any finite quantity of its own nature, or so small as to be less. In the first case it is said to be infinite, and in the latter infinitely small. These magnitudes are of course imaginary, as in both cases quantities may be conceived either greater or smaller: so that an infinitely large quantity may be considered as nothing, or zero, and an infinitely small quantity as the same, when compared with one another. In the differential calculus, the infinitely small quantities which come under consideration are called *differentials*. The differential of a magnitude, or variable function, as it is called, is expressed by placing the letter d before the magnitude or function. Thus dx signifies the differential of the variable magnitude x. Formerly it was the custom to put a dot over the *fluxion* of a quantity, as it was then called. The use of the letter d was introduced by Leibnitz, who, contemporary with Sir Isaac Newton, gave much attention to the subject. These two philosophers, independently of one another, studied the science of the differential calculus at the same time; but of late years the method of Leibnitz has almost exclusively prevailed, to the exclusion of the name, notation, and method of Newton's fluxions, in such points as they differ.

DIFFRACTION OF THE RAYS OF LIGHT, *dif-frak'-shun* (Lat., *diffractum*), the modification which light undergoes in passing very near the edges of any opaque body. It was first observed by Grimaldi, who noticed that when a ray of light was allowed to enter a dark room, the shadows cast from any opaque body were larger than if the light passed by it in straight lines, and that those shadows have three bands of coloured light parallel with them. At first this phenomenon was attributed to the refracting power of the atmosphere; but this theory was disproved by Newton, who treats of the subject in the last book of his Optics. He endeavoured to explain its occurrence through the general properties of light. It is now looked upon as identical with many phenomena connected with the undulatory theory of light, and is assigned to the interference of undulations.

DIFFUSION, *dif-fu'-zhun* (from Lat., *diffundo*, I pour out hither and thither), the gradual dispersion of particles of one liquid or gas among those of another, or of the particles of a solid in a liquid holding it in solution.

Of Gases.—If two vessels be filled with two different gases, and connected by a tube, it will be found that, after a certain lapse of time, an intimate and equal intermixture of them will take place. If, however, means be taken to measure the velocity with which they mix, it will be found that the lighter of the two diffuses itself much more rapidly into the heavier than *vice versâ*. Professor Graham and others have determined the exact rates of diffusion of all gases, which appear to be in accordance with a law that the relative diffusiveness of gases is unity divided by the square root of their density, taking air as the standard. Diffusion of gases is a process that is continually going on around us. Were it not for this property, gases deleterious to animal and vegetable life would be constantly accumulating in poisonous masses, instead of being silently and harmlessly distributed through the atmosphere.

Of Liquids.—Liquids of different densities, like gases, gradually diffuse into each other when brought into contact. Thus, if a salt-jar be filled with water, and red wine be gradually and carefully conveyed to the bottom of the vessel, it will be found that, after the lapse of a few days, the wine will gradually diffuse itself into the water and the water into the wine, until the whole is uniformly mixed. By means of an apparatus of this kind Professor Graham was enabled to calculate the different velocities of a large number of substances. These velocities vary in the most remarkable manner, sulphuric acid, for instance, diffusing into water with twenty-four times the velocity of albumen. Pursuing these experiments, he was at last able to classify all soluble substances according to their velocities, and in doing so he made the remarkable discovery that a diaphragm covered with a layer of a solution of low velocity totally interrupted the passage of a solution of still lower power of diffusion through its mass. Carrying these ideas further, he has classified all soluble substances under two heads—*colloids*, or amorphous substances similar to gelatine, which he takes as the type of the class; and *crystalloids*, or substances taking a crystalline form, and having a high diffusive velocity. These two classes seem to be divided naturally by other characteristics than velocity of diffusion. All crystalloids are more or less rapid, while colloids, such as starch, dextrin, albumen, &c., are insipid, and soluble with difficulty. Colloids offer but little resistance to the diffusion of crystalloids through their mass, while they are in a manner impervious to substances of their own class. On this property Mr. Graham has founded his system of dialysis, or the separation of the crystalloid and colloid constituents of a liquid by the intervention of a colloid septum. (*See* DIALYSIS.)

DIGESTION, *di-jes'-tshun* (Lat., *digestio*, from *digero*, I carry to different parts, or dissolve), in Physiology, is that process by which the food of animals is converted into chyme in the stomach, and prepared for being ultimately taken into the blood. The principal processes connected with digestion are usually represented as—(1) Mastication; (2) insalivation; (3) deglutition; (4) chymification, or the action of the stomach; (5) chylification, or the action of the intestines; (6) defæcation; and (7) the absorption of the chyle. The operation of mastication is a very important auxiliary to digestion; since the more the food is broken down and mixed with the saliva the more readily and completely will it be acted upon by the stomach. Imperfect mastication is a frequent cause of indigestion. During this process the salivary glands yield up their contents, by means of which the dry food is moistened and rendered more fit for deglutition. The third process is the act by which the food is transferred from the mouth to the stomach. (*See* DEGLUTITION.) The alimentary matter being propelled by the contractions of the œsophagus into the cardiac extremity of the stomach, is there acted upon and dissolved by the gastric juice, which is secreted by glands lying in its inner or mucous coat. This process is assisted by the muscular contractions of the stomach, by means of which the mass is kept in motion until it is formed into chyme. When it has been sufficiently operated upon, it passes through the pyloric opening into the duodenum. The plyorus possesses a peculiar sensibility, that prevents any matter from passing through it but such as has been properly converted into chyme. Recent investigations have shown that the changes which the food undergoes in the stomach are essentially chemical. (*See* GASTRIC JUICE.) The process of gastric digestion is very slow. It is more than an hour before the food suffers any apparent change; and the ordinary time required for the digestion of animal food is from three to four hours. The chyme having passed through the pylorus into the duodenum, becomes mixed with the biliary, pancreatic, and intestinal secretions. These juices, by their action upon the chyme, separate it into two portions—one a milky fluid called chyle, the other the excrementitious portion. The bile seems to be of use principally in promoting the digestion of fatty matters, while the pancreatic juice serves mainly to convert starchy matters into sugar. Of the use of the intestinal juice little is known. The chyle attaches itself to those irregular circular folds of the mucous membrane of the small intestines, called the valvulæ conniventes, where it is absorbed by the lacteals. The large intestines also possess lacteals; so that, if any portion of the chyle should not have been absorbed in the small intestines, it is taken up in the large ones. The fæces pass gradually from the small to the great intestines, until they reach the rectum, where they are retained for some time and then discharged. The absorption of the chyle forms the last act in the process of digestion. It is, as we have already seen, taken up by the lacteals, and is by them conveyed to the mesenteric glands, where it is supposed to undergo some change. From thence it makes its way to the right side of the aorta, in the lumbar region, where it is finally discharged into an elongated pouch, called the receptaculum chyli. From this pouch the thoracic duct conveys the chyle upwards to the left side of the neck, where it is poured into the left subclavian vein at its junction with the internal jugular, and, being thus mixed with venous blood, it is carried to the lungs and there converted into new and perfect arterial blood.

DIGITALIS, *dij-it-ai'-lis* (Latin, *digitus*, a finger), a genus of plants belonging to the natural order *Scrophulariaceæ*. The most important species is *D. purpurea*, the purple foxglove, one of the handsomest of our indigenous plants. It is a biennial, blossoming during the months of June and July, and is found on hedge-banks and the sides of hills, in dry, gravelly, or sandy soil. The flowers are somewhat bell-shaped, and their remote resemblance to the fingers of a glove suggested the generic name. They are beautifully marked on the inside with purple blotches. The foxglove sometimes grows to the height of six, or even seven feet. A variety commonly met with in gardens has white flowers spotted with different shades of cream-colour and pearl. The wild foxglove is a most important medicinal plant. The leaves only are officinal in our pharmacopœias; but the seeds and roots possess similar properties. Digitalis is a diuretic, and greatly resembles tobacco in many of its properties. It is employed to reduce the action of the heart in diseases of that organ, in fever, and in inflammations. It is prescribed as a diuretic in dropsies of all kinds, but is most useful in those associated with a debilitated and generally diseased state of the constitution. It is a violent poison, and great care is requisite in prescribing it, as its use, even in small doses, has led to fatal results, for it accumulates in the system. The active principle of foxglove is termed *digitaline*.

DIGITIGRADA, *dij'-it-e-grai'-da* (Latin, *digitus*, a finger; *gradior*, I walk), in Cuvier's zoological system, a tribe of carnivorous animals distinguished by walking upon the toes, the heel being always raised from the ground. Those animals which place the heel or the sole of the foot on the ground belong to the tribe *Plantigrada*. Some of the most carnivorous mammalia belong to the digitigrada. The feline and canine families, hyænas, civets, &c., are all included in it. The Weasel family (*Mustelidæ*) appears to form a connecting link between the digitigrada and the plantigrada.

DIKAMALLI, *di-kam-al'-li*, a gum resin obtained from young shoots of an Indian tree, *Gardenia lucida*. It is very fragrant, and is used as a dressing for wounds and running sores.

DILL. (*See* ANETHUM.)

DILLENIACEÆ, *dil-len-e-ai'-se-e* (after the botanist Dillenius), the *Dillenia* family, a natural order of dicotyledonous plants, in the sub-class *Thalamifloræ*, consisting of trees, shrubs, and a few herbs. The order includes between 20 and 30 genera, and about 200 known species, occurring chiefly in Australia, India, and equinoctial America. They have astringent properties, and many are used for tanning and as vulneraries. The young calyces of some species of the typical genus *Dillenia* have an acid taste, and are employed to flavour curries in some parts of India. Many species of this genus grow to a large size, and form hard durable timber. Those of India are generally remarkable for fine evergreen foliage and very beautiful flowers. They are sometimes cultivated as stove or greenhouse plants in this country.

DILLESK. (*See* RHODOMENIA.)

DILUENTS, *dil'-u-ents* (Lat., *diluo*, I wash away), liquids administered to increase the fluidity of the blood, and render certain of the secretions and excretions less viscid. They likewise promote the operation of more active medicines, especially aperients and diuretics. Water is the simplest and frequently the best diluent; or it may be made more agreeable by the addition of acid or other substances, or in the form of toast-and-water. Gruel, barley-water, infusion of tea, mutton and chicken broth, beef-tea, and such like, come under this designation. Diluents are of great use in allaying the thirst of patients affected with fever or other inflammatory complaints, and are often very useful in subduing the more violent symptoms of the disease, and relieving the system by means of perspiration.

DILUVIUM, *di-lu'-ve-um* (Lat., *dis*, asunder; *luere*, to wash), a term applied to accumulations of gravel, sand, or stones, which are referred to the *extraordinary* action of water, the term alluvium implying the *ordinary* operations of water. At one time geologists merely used the word diluvium to distinguish accumulations supposed to have been formed during the Noachian deluge; but we now employ it as a common name for all masses which have apparently been produced by powerful aqueous agency.

DIMENSION, *dim'-en-shun* (Lat., *dimensio*), in Geometry, signifies the extent of anything. A line, whether straight or curved, has only one dimension—length; a surface has two dimensions—length and breadth; while a solid has three—length, breadth, and thickness. All forms of extension can be determined by these three dimensions.

In Algebra, the term dimension is applied to the number of true factors to a term, and is used very much in the same sense as *degree*. An equation is generally said to be of as many dimensions as there are units in the index of the highest power of the unknown quantity.

DIMORPHISM, *di-mor'-fizm* (Gr., *dis*, twice; *morphe*, form), the property possessed by certain bodies of assuming crystalline forms which cannot be derived from each other. Instances of this occur in the case of sulphur, which crystallizes as oblique prisms and as octahedra, according as it is crystallized by heat or from the solution in bisulphide of carbon.

DINGO, *ding'-go* (*Canis dingo*), the native dog of Australia, regarded by some naturalists as a distinct species, but more generally as the descendant of a race once domesticated, and returned to its wild state. It is found in Australia both in a wild and tamed state; the tame dingo being about the size of our familiar sheep-dog, and the wild one somewhat larger. The latter has a large head, with a fuller muzzle than the sheep-dog; ears short and erect; tail bushy; colour tawny. It does not bark, and is very destructive to the sheep of the colonists, it continues to strangle as many sheep as its strength will allow before it squats down to pick a bit of one.

DINORNIS, *di-nor'-nis* (Gr., *deinos*, wonderful or terrible; *ornis*, a bird), a genus of large birds of the tribe *Brevipennes*. No species of the dinornis now exists, but many bones belonging to birds of this class have been found in New Zealand, not only in the most recent deposits, but in the sand by the sea-shore, in caves, in swamps, in the soil of forests, and in river-beds. Among the natives there are many traditional reports about these birds, which were called *moa*, and are said to have possessed gorgeous plumage, for the sake of which they were hunted. They probably existed as late as the 17th century. The dinornis must have been considerably larger than any bird now existing; some of the bones found are twice as large as those of the ostrich; and the toe bones almost equal in size those of the elephant. The body must have been very bulky, and somewhat similar to that of the extinct dodo. The *Dinornis giganteus* must have been nearly eleven feet high. The number of bones of the dinornis that have beeen found is very great. Several species have been recognised, and some skeletons have been nearly completely restored.

DINOSAURIA, *di-no-saw'-re-a* (Gr., *sauros*, a lizard), a term applied to distinguish an order of extinct lizards found as fossils in the lias, oolite, and wealden formations. The dinosauria were enormous reptiles of the lizard class, which approached nearer to the mammal type than any other of their order. Four powerful limbs supported their bodies, and the sacrum was composed of five vertebræ amalgamated. The Megalosaurus, the Iguanodon, and the Hylæosaurus are the principal genuses of the order.

DINOTHERIUM, *di-no-the'-re-um* (Gr., *therion*, a wild beast), an extinct animal the cranial bones of which are found in the miocene formations of Germany, France, &c. Like the elephant, this remarkable animal was provided with a pair of formidable tusks, which projected downwards from the lower jaw. It was also provided on each side of its jaws with five double-ridged grinders. From the largeness of the nasal cavity, it is supposed that the animal had a trunk like the elephant. As none of the body or limb bones of the dinotherium have been found, its true position in the system of nature is not accurately determined.

DIODON, *di'-o-don* (Gr., *dis*, twice; *odous*, tooth), a genus of fishes of the family *Diodontidæ*. These fishes are about two feet in length, of a nearly spherical form, and possess the power of inflating or contracting themselves at pleasure. When their stomachs are thus distended with air, there are displayed over the entire surface numerous spines, as though to protect its now somewhat unwieldy body from attack. It is, doubtless, this latter circumstance that has procured for the fish the titles of sea-porcupine and globe-fish. When inflated, the globe-fish is incapable of swimming, but floats with the stream. They are found in warm seas. The sun-fish is of this family.

DIŒCIUS, *di-e'-se-ous* (Greek, *dis*, twice, and *oikion*, a habitation), a term applied to plants or flowers, the male and female flowers of which are produced on separate plants. Most species of willow are familiar examples.

DIONÆA, *di-o-ne'-a* (from Dioni, one of the names of Venus) a genus of plants belonging to the natural order *Droseraceæ*. The only species known is *D. muscipula*, a native of North America. This plant affords a remarkable instance of vegetable irritability. The leaf is two-lobed, and each lobe is furnished on its upper surface with three stiff hairs, which, on being touched by an insect or any other object, cause the two halves to collapse and inclose the object. The plant is commonly known as Venus's fly-trap, or Carolina Catchfly plant.

DIOPSIS, *di-op'-sis*, a genus of dipterous insects, remarkable for the great length of the pedicles on which the eyes are situated. On this account it is likewise termed the telescope-fly. All the species are found in warm parts of the old world.

DIOPTRICS, *di-op'-triks* (Gr., *dioptrikos*).—That portion of geometrical optics which treats of the passage of rays of light from one medium to another of a different kind. (*See* REFRACTION, OPTICS.)

DIOSCOREA, *di-os-kor'-e-a*, the typical genus of the natural order *Dioscoreaceæ*. Various species, as *D. alata*, *sativa*, and *aculeata* produce the tubers called yams, which, when boiled, are eaten in tropical countries as the potato is eaten in Europe.

DIOSCOREACEÆ, *di-os-kor-e-ai'-se-e*, the Yam family, a natural order of monocotyledonous plants in the sub-class *Dictyogenæ*, consisting of shrubby plants with twining stems rising from tuberous root-stocks, or tubers placed above or under the ground, and having net-veined leaves, and small-spiked bracteated flowers. They are natives chiefly of tropical countries, a few only being found in temperate regions. They are generally characterised by great acridity, though farinaceous matter adapted for food exists in the tubers of many species. (*See* DIOSCOREA, TAMUS, TESTUDINARIA.)

DIOSPYROS, *di-os'-pi-ros*, a genus of dicotyledonous trees, belonging to the natural order *Ebenaceæ*. Many of the species have hard and dark-coloured heart-woods, which constitute the different kinds of ebony; thus *D. ebenum* furnishes Mauritius ebony: *D. melanoxylon*, a native of the Coromandel coast, the sort commonly known as black ebony: and *D. ebenaster*, the bastard ebony of Ceylon. The beautifully variegated furniture-wood called Coromandel or Calamander wood, is obtained from *D. hirsuta*, and is brought to Europe from Ceylon. Other species also yield valuable timber. The fruit of *D. Kaki* is eaten in China and Japan, and is known in the latter country as the keg-fig. The fruit of *D. Virginiana*, a native of the United States, is sweet and edible when quite ripe, but very austere before then; hence it is frequently employed medicinally in its unripe state as an astringent.

DIP, *dip* (Ang.-Sax.), a miner's and geologist's term for the direction of any mineral vein or stratum in relation to the horizon.

DIP OF THE MAGNETIC NEEDLE. A very remarkable property of the magnetic needle was discovered in 1576, by Robert Norman, an English seaman; and was perfectly inexplicable till Gilbert's suggestion that the earth was a magnet threw some light on it. Norman observed that the needle had a tendency to "dip," that is, to point downwards as well as in a northerly direction, and that the tendency increased in a regular manner as the north or south pole was approached. Careful experiments and systematic records of observations have made known some striking results. A magnetized bar or needle, suspended by the centre so as to permit free movement, in tropical regions remains in a horizontal position; but dips as higher latitudes are reached, until at certain spots in the polar regions it becomes vertical, pointing directly to the earth. At these spots north and south are, it would seem, the magnetic poles. In 1832, Commander James Ross observed that the needle was in an exactly perpendicular position at a spot in that part of the Arctic regions named by Captain Ross Boothia Felix, lat. 70° 5′ N. and long. 96° 46′ W. A few years afterwards Commander Ross visited the Antarctic regions, and although he was unable to reach the south magnetic pole, the angle at which the needle continued to dip enabled him to fix the point at about lat. 70° S. and long. 125° E. As in the case of the horizontal variation of the needle, the angle of dip varies in the progress of time at the same place.

Dipping Needle.—The instrument with which the observations of the dip are made consists of a frame in which a graduated circle is fixed in a vertical position. The frame moves on a graduated circle in a horizontal position, fixed on a small tripod that can be adjusted by means of levelling screws. The needle is suspended on two knife-edges of agate, fixed in the frame exactly in the centre of the vertical circle, and moves freely in any direction in a vertical plane.

DIPHTHERIA, OR DIPHTHERITIS, *dif-the'-re-a* (Fr., *diphtherite*, from Gr., *giphthera*, a skin or membrane), a malignant and generally fatal disease of the throat. It was first observed and described by M. Bretonneau, of Tours, in France, where it prevailed as an epidemic in 1818. It subsequently broke out in other French towns, and in 1857 it made its appearance in England, where it has since been, unfortunately, by no means rare, and has already caused a large amount of mortality. It is characterized by a peculiar inflammation of the mucous membrane of the throat, or pharynx, accompanied by the production of a false membrane. At first this membrane appears in the form of a white spot on the pharynx or tonsils, from which it gradually extends forwards to the soft palate and into the nostrils, and backwards into the œsophagus, sometimes into the larynx, but seldom into the trachea, producing at length suffocation. It is usually accompanied by a fœtid discharge from the nose and mouth, and hæmorrhage frequently occurs. There is usually, also, a low and dangerous form of fever, with great depression of spirits and rapid decrease of the patient's strength, which is still further accelerated by his inability to take food. Various modes of treatment have been recommended; but success is in all cases extremely uncertain. The patient's strength is to be supported by means of tonics and stimulants. Quinine is generally recommended; and in most cases wine may be given with advantage. In the local treatment of the throat, nitrate of silver and chlorine are used.

DIPLACANTHUS, *dip-li-kan'-thus*, a species of fossil-ganoid fishes, found in the old red sandstone. Six species have been found.

DIPLOGRAPSUS, *dip-lo-grap'-sus*, a genus of fossil zoophytes, found in the anthracitic shales of the Silurian measures.

DIPPER (*Cinclus*), a genus of birds of the Thrush family, the British representative of which is the common dipper, or water-ousel, found also throughout the whole of Europe and the north of Asia. This bird is rather smaller than the thrush, of a dark-brown colour, with throat and upper parts pure white. The facility with which the dipper dives and pursues its prey beneath the water is very remarkable. It builds a very curious nest, composed of moss, domed, and with an entrance at the side: the site chosen is generally the bank of a stream, or sometimes under a cascade.

DIPSACACEÆ, *dip-sa-kai'-se-e*. (*See* TEASEL.)

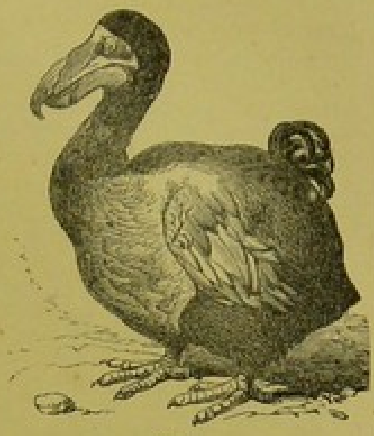
DIPSAS, *dip'-sas* (Gr., a kind of serpent), a genus of non-venomous tree snakes of the family *Colubridæ*. They are very long and slender, with broad obtuse heads. A very beautiful species, the *D. Cyanodon*, is found in Java and Sumatra.

DIPSOMANIA, OR OINOMANIA, *dip-so-mai'-ne-a* (Gr., *dipsa*, thirst; *oinos*, wine; *mania*, madness), a term recently applied to an inordinate or insane craving for alcoholic stimulants. Lately medical men have come to the opinion that the inveterate drunkard is to be regarded as habitually under the influence of an insane impulse which it is impossible for him to resist. (*See* INSANITY and INTOXICATION.)

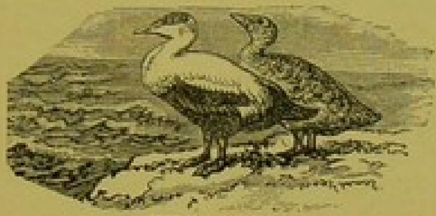
DIPTERA, *dip'-ter-a* (Gr., *dipteros*, two-winged), an order of insects, having for their most conspicuous character only two wings, corresponding to the anterior pair of four-winged insects. They are also distinguished by having two clubbed appendages, called *halteres* or balancers, which seem to be the rudiments of two posterior wings. In ordinary language the diptera are called flies, usually with some character-

FLYING DRAGON.

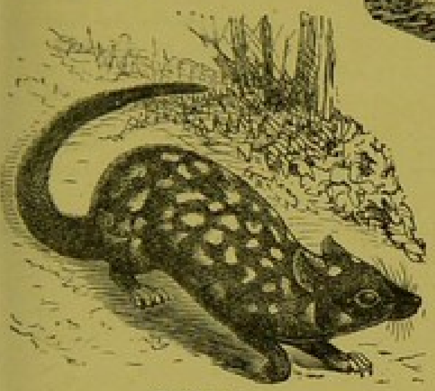
DUCKBILL, PLATYPUS.



DODO.

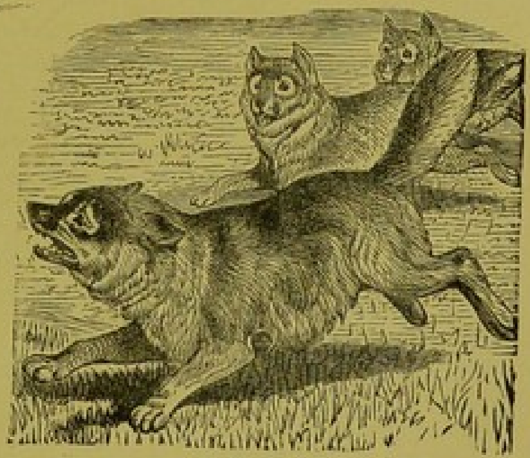


EIDER DUCK.



DASYURE.

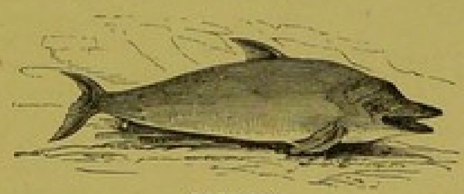
DOG WOOD.



DINGO.

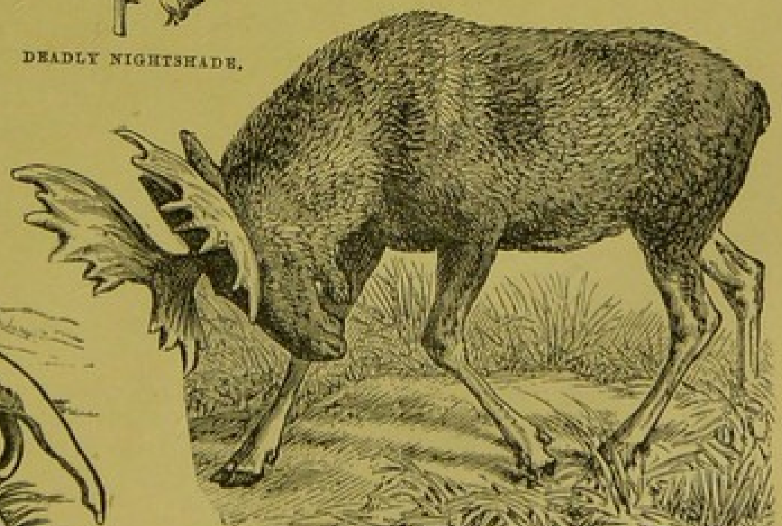
DINOTHERIUM. SKULL OF.

DEADLY NIGHTSHADE.



DOLPHIN.

DINOTHERIUM.



MOOSE DEER.

istic prefix; such as the housefly, blow-fly, &c. Mosquitoes, gnats, and midges belong to the diptera. It is one of the most extensive of the orders of insects, and some of the species are remarkable for the extraordinary numbers in which they appear. Dipterous insects are also distinguished by having the mouth in the form of a sucker, composed of from two to six lancet-shaped elongated scales, inclosing a canal upon the upper surface of the tongue or proboscis.

DIPTERACEÆ, *dip-ter-ai'-se-e*, the Sumatra camphor family, a natural order of dicotyledons, in the sub-class *Thalamifloræ*, consisting of large trees, with simple alternate involute leaves and large deciduous convolute stipules. The flowers are perfect and symmetrical. The plants of this order are all natives of the forests of the tropical East Indies, with the exception of the genus *Lophira*, which belongs to tropical Africa. The useful products of the order are oleo-resinous substances. (*See* DIPTEROCARPUS, DRYOBALANOPS, VATERIA.)

DIPTEROCARPUS, *dip-ter-o-kar'-pus* (Gr., double-winged carpel), a genus of plants belonging to the natural order *Dipteraceæ*. Several species, as *D. turbinatus*, *costatus*, *alatus*, and *incanus*, yield an oleo-resinous substance, called wood-oil or Gurjun balsam, which resembles in its properties the so-called balsam of copaiba, and which is used for similar purposes. In Java, banana leaves are smeared with this resin and used for torches. In India wood-oil has been employed for painting houses.

DIPTERUS, *dip'-ter-us*, a genus of fossil-ganoid fishes, deriving their name from the double anal and dorsal fins. They are peculiar to the old red sandstone.

DIPTERYX, *dip'-ter-iks*, a genus of plants belonging to the natural order *Leguminosæ*, sub-order *Papilionaceæ*. The seeds of *D. odorata*, a native of Guiana, have a very powerful and agreeable odour, which is due to the presence of a volatile oil containing coumarin. They are used for scenting snuff and in perfumery, and are commonly called Tonquin or Tonka beans.

DIRECT AND RETROGRADE, *di'-rekt ret'-ro-graid* (Lat., *directus*, *retro*, backwards, and *gradus*, a step), in Astronomy, when the motion of any heavenly body is from west to east, or in the direction and order of the signs of the zodiac, it is said to be direct; when the motion is in the contrary direction, or from east to west, it is said to be retrograde. The motion of all the heavenly bodies, except some of the comets, is direct.

DIRT-BEDS, *durt*, in Geology, dark-coloured loam-like beds that occur interstratified with the oolitic limestones and sandstones of Portland, and which are evidently the soils in which the cycads and zamias of the period grew. Stumps of trees in an erect position, with their roots extending beneath them, have been found in these strata.

DISC, *disk* (Lat., *discus*), a term now applied by botanists to whatever intervenes between the stamens and the ovary upon the thalamus. It presents great variety of forms: thus in the orange it forms a fleshy ring, surrounding the base of the pistil; in the tree pæony, a dark-red cup-shaped expansion, covering nearly the whole of the pistil except the stigmas; in the rose, a sort of waxy lining to the tube of the calyx; in umbelliferous plants, a swelling on the top of the ovaries, adhering to the styles. In other cases, the disc is reduced to little separate glandular bodies, as in cruciferous plants; or to scales, as in the vine; or to various petaloid expansions, as in the aquilegia.

DISC, the surface of a circular plate of metal or other substance; a thin circular plate of any substance.

In Astronomy, the body or face of the sun and moon, such as it appears to us; for though they are really spherical bodies, they are apparently circular planes.

Disc and Discobulus. (*See* QUOITS.)

DISCOBOLI, *dis-kob'-o-le*, a family of malacopterous fishes, known also as the *Cyclopteridæ*, having the ventral fins united to form a sucking disc on the under surface of the body; by which it is enabled to attach itself to fixed substances, and avoid being swept away by the current. The lumpsucker, *C. lumpus*, belongs to this family.

DISCUTIENT, *dis-ku'-te-ent* (Lat., *discutio*, I destroy), a term applied to remedies that discuss or disperse morbid matter.

DISEASE, *diz-eze'* (Ang.-Sax.), a negative of "ease," is a departure from the state of health in which the due balance between the several parts or properties of the animal frame is maintained. It is "a changed condition or proportion, in function or structure, in one or more parts of the body." Diseases of function are deviations from a standard furnished by physiology, and diseases of structure a departure from a standard supplied by anatomy. These, however, are usually combined; for there is seldom structural disease without some disorder of function; and in many instances functional diseases are, or ultimately will be, accompanied by change of structure. The causes of disease may be either intrinsic, existing within the body, or independent of any obvious external influence; or they may be extrinsic, having their origin without the body. The latter embrace all the external agencies that can operate either on body or mind; as temperature, air, food, poison, sensual impressions, and the like. Causes of disease, however, are often present without disease ensuing, some frames being less susceptible to particular causes of disease than others. Hence physicians distinguish two kinds of causes—predisposing and exciting; the former being circumstances which so influence the functions or structures of the body as to render it unusually susceptible to the influence of particular exciting causes—that is, of such circumstances and agents as seem to more immediately operate in producing disease, especially when in a state of predisposition. The classification and arrangement of diseases according to their external characters is termed Nosology; and that branch of science which more particularly regards the nature and progress of disease with a view to its cure, is called Pathology. (*See* NOSOLOGY, PATHOLOGY.)

DISINTEGRATION, *dis-in-te-grai'-shun* (Lat., *dis*, *integer*), the act of separating the integrant parts of a substance, as distinguished from decomposition, or the separation of constituent parts. Disintegration refers more particularly to the mechanical diffusion of a substance; decomposition, to the chemical division.

DISLOCATION, *dis-lo-kai'-shun* (Lat., *disloco*, I put out of place), is the displacement out of their natural position of bones articulated together or forming a joint. It is usually occasioned by external violence; but may also, in some cases, result from diseases of the joint. Dislocation is either complete or incomplete; being incomplete when the articular surfaces remain partially in contact, and complete when there is an entire separation. It is simple when there is no wound and the skin remains unbroken; compound, when there is a wound, by means of which the external air may communicate with the joint. When, besides the dislocation, there are fractures of the bones or laceration of important organs, then it is termed a complicated dislocation. Nearly all the bones of the human body are liable to displacement; but some are much more so than others; as those of the shoulder, hip, elbow, ankle, &c. Generally, those joints are the most liable to dislocation that admit of the greatest extent of motion. Dislocation is in most cases easily observable; but in some parts it is extremely difficult of detection. It is attended with loss of power and motion in the part, with more or less of swelling and pain, which is increased on moving the part; the patient feels sick and faint, and there is a sensation of numbness in the part. Dislocations should be reduced as soon as possible after their occurrence; for the longer it is delayed, the more difficult will be the operation. Dislocations are reduced by pulling gently, yet firmly and steadily, for some minutes, until the muscles are fatigued, and the head of the bone brought down below the level of the joint, when, by being gently lifted over the edge of the socket, it falls into its place, upon the extending force being slightly relaxed. The force required is often very considerable, and sometimes it is necessary to have recourse to a block and pulleys, in which case the body is securely fixed by proper bandages to a staple in the wall, or other sufficient support. In order to overcome the violent contraction of the muscles, it was sometimes necessary formerly to weaken the patient by blood-letting, emetics, &c.; but latterly chloroform has been most commonly resorted to for this purpose. After reduction it is necessary that the joint be kept in a state of perfect rest for some time, in order to allow the ruptured ligaments to unite; otherwise the accident will ever afterwards be liable to recur. When a dislocation has been left unreduced, the parts come to adapt themselves to their new situation; a new socket is formed for the head of the bone displaced, the old socket becoming absorbed or filled up. Compound dislocations are generally attended with danger, and, when occurring in the large joints, are usually fatal, or require amputation.

Dislocation, in Geology. (*See* FAULT.)

DISPERSION, *dis-per'-shun* (Lat., *dispergere*, from *dis*, a particle denoting separation, and *spargere*, to scatter), the term applied to the separation of a ray of white light into its several component coloured parts by refraction, through the instrumentality of a prism. (*See* PRISM and SPECTRUMS.) In Optics the term is often applied to the reflection or scattering of rays of light from any polished and reflecting surface. The amount of light actually reflected, according to the regular law, varies with the nature of the reflecting surface. The loss by this dispersion is about one-third for a perpendicular looking-glass, and a little less for highly polished speculum metal.

DISSECTION, *dis-sek'-shun* (Lat., *dis*, and *seco*, I cut), is applied to the cutting or dividing of the different parts of the body in anatomy. The practice of dissection is essential to a course of medical study. (*See* ANATOMY.)

DISSOCIATION, *dis-so-si-a'-shun* (Lat., *dis*, apart, and *socius*, a companion). The influence of heat and pressure on chemical action. The theory of M. Deville, who first used the word, was, that, by selecting a proper compound and heating it sufficiently, the distance between the molecules can be increased to such an extent that they will separate into their elementary condition. This is a spontaneous decomposition, not determined by any chemical action. There has been much controversy on the subject.

DISSOLUTION, *dis-so-lu'-shun* (Lat., *dissolutio*, from *dis*, and *solvo*, I set free), a term variously applied, but in its commonest and most general sense implying the separation of the parts of a body which in the natural condition are united. The state of being liquefied by heat or moisture is termed dissolution; thus, ice is changed from a solid into a fluid state by heat; metals, again, can undergo dissolution by the action of an acid menstruum. The separation of the soul from the body is termed dissolution, or, more generally, death. (*See* DEATH.) Dissolution of the blood denotes that condition of the vital fluid in which it does not readily coagulate on its cooling, out of the body, as in the case of malignant fever.

DISTEMPER, a disease to which young dogs are liable. It is supposed to have been derived from France, and is considered to be a typhoid inflammation affecting the upper air-passages. It closely resembles the strangles of young horses, and the scarlatina and such-like diseases to which young children are liable. The disease is contagious, occurs generally only once in a lifetime, runs a definite course, and is accompanied by low fever and debility. A dog with the distemper is easily recognised. The eyes become red, weak, and watery; the nose hot and dry; any movement in the air excites a cough or sneeze; and there is a general dulness, fever, and loss of appetite. The running from the nose, as the disease proceeds, becomes, after some days or weeks, mucous or purulent, loading the eyes and obstructing the nostrils. It then lodges in the bronchial tubes, preventing the free access of air and the purification of the blood. All dogs are subject to distemper; but highly-bred, delicate, and fancy dogs are most liable to the disease, and the mortality amongst them is the greatest. In the cure of distemper all irritating and reducing remedies must be avoided. If the stomach is overloaded, it should be relieved by a mild emetic; and if no effect is produced by the dose, it should be repeated in twenty minutes. To ward off distemper, young dogs should be very liberally and nutritiously fed. In such cases, in spite of all care if they are attacked with distemper, they are almost certain to pass over it very favourably.

DISTORTION, *dis-tor'-shun* (Lat., *distortio*, from *distorqueo*, I twist), in Surgery, is a permanent deviation from the natural shape or position of the body, producing visible deformity. Distortions may arise from various causes. They generally occur after birth, and thus differ from deformities, which are for the most part congenital. Distortions are frequently occasioned by affections of the muscles or nerves. It is well known that every movable part of the body is furnished with two sets of muscles acting in contrary directions, by means of which it is not only moved, but also retained in its natural position. Hence it is evident that if, by means of any injury to one of the sets of muscles, or of the nerves communicating with them, their contractility is destroyed or impaired, the part can no longer be maintained in its natural position, but will be drawn towards the antagonistic muscles. In this way various kinds of lameness, wry neck, squinting, &c., are produced. The most common cause of distortion, however, is disease of the bones. These are sometimes deficient in the earthy matter which gives them hardness and rigidity, and thus are incapable of supporting the weight of the parts which they are designed to bear, or of sustaining the muscular action, without becoming bent and distorted. From this arises the disease known as rickets (which *see*). The distortion known as the lateral curvature of the spine arises from weakness in the vertebral muscles, inducing a habit of resting the weight of the body more on one side than the other. Unlike rickets, which commence early, this does not usually make its appearance before the tenth year, and is most commonly found among slender and delicate females in the higher and middle ranks of life. It is generally occasioned by too much confinement and restraint, and is best got rid of by plenty of free exercise of the limbs in the open air. Angular curvature of the spine differs entirely from the above, and is occasioned, for the most part, by ulceration of the body of one or more of the vertebræ. The support in front being thus lost, the spine is bent sharply forwards, and one or more of the spinous processes project behind. Perfect rest in the horizontal position, issues and setons in the neighbourhood of the diseased bone, and attention to the general health, is the treatment to be adopted in this case. Diseases of a similar kind frequently occur in the bones and joints of other parts of the body, and require similar treatment. Distortions may also arise from a variety of other causes; as rheumatism, gout, burns, and various chronic and local affections; but these come more properly for consideration under their own heads.

DISTRIBUTION OF ANIMALS AND PLANTS. (*See* PHYSICAL GEOGRAPHY.)

DITHIONIC ACID, *dith-e-on'-ik*, also called hyposulphuric acid—the second of the *thionic* series of sulphuric and oxygen compounds, all of which contain five equivalents of the latter.

DITTANY, *dit'-ta-ne*, a genus of plants (*Dictomnus*) of the natural order *Rutaceæ*. The common dittany or fraxinella (*D. altus*) is found in the elevated forest regions of Southern Europe, and is cultivated as a garden flower. It is a perennial from two to three feet high, with flowers generally of a fine rose colour, but sometimes white. The plant contains a great amount of volatile oil, and is peculiarly fragrant.

DIURETICS, *di-u-ret'-iks* (Gr., *diouretikos*), those agents which have the power of augmenting the secretion of urine. Their action is beneficial whenever the system is troubled with an excess of fluids or of salts and nitrogenous substances derived from effete tissues.

DIVERGING LINES, *di-verj'-ing* (Lat., *divergo*, I tend from), a term employed in Mathematics and Optics to denote those lines which separate or recede from one another after proceeding originally from the same point. In Mathematics, a diverging series is one of which the terms increase more and more the further it is continued.

DIVERS, *di'-verz* (*Mergus*), a genus of birds of the family *Colymbidæ*. They closely resemble the grebes; indeed, the chief point of difference consists in the former having palmated feet. They have strong, straight, rather compressed pointed bills, about as long as the head; short rounded tails; short wings; their legs placed far back, and toes completely webbed. They fly well, and, as divers, are remarkably expert. They measure usually from two and a-half feet to three feet in length, and are essentially inhabitants of high northern latitudes, visiting our shores in the autumn, remaining through the winter, and quitting us in the spring to seek their northern breeding-stations. The great northern diver (*Colymbus glacialis*) is the largest of the tribe. It measures full three feet in length, and four feet six inches in breadth. The head and neck are black, shaded with purple and green. At the back of the neck there is a white crescent-shaped band, marked with black oblong strokes pointing downwards. The breast and underside of the body are white; the back, wing-coverts, and scapulars are black, thickly dotted with white. The red-throated diver (*Colymbus septentrionalis*) is smaller than the great northern, and lighter coloured. In habitat, however, they exactly agree.

DIVISIBILITY, *div-iz-e-bil'-e-te*, the property possessed by all bodies of being separable into parts. (*See* ATOMIC THEORY and HOMŒOPATHY.) The diffusion of odours through the atmosphere shows the minute division of material particles; and the tinging of large quantities of fluid with minute portions of colouring matter is an instance of the same. In the theory of numbers, the term divisibility indicates the capability of any number being divided by another without remainder.

DIVISION, one of the principal rules of arithmetic. By this operation can be determined how often one quantity is contained in another. The *dividend* is the number to be divided; the *divisor*, that by which the dividend is to be divided; and the *quotient*, the result. Division is divided into two classes—arithmetical division and algebraical division. In arithmetical division, when the numbers are expressed in the scale of tens, the following is the mode of working:—On the left-hand side of the dividend is written the divisor, separating them by a line. Beginning with the highest order of units of the dividend, the lower orders are passed over until the fewest number of figures is found that will contain the divisor; it is next determined how many times the divisor is contained in these figures, and the number is written on the other side of the dividend, beginning from the left for the first figure of the quotient. The divisor is then multiplied by this figure of the quotient, and the product placed under the figures of the dividend used, and subtracted from them, and the next figure of the dividend is brought down to the remainder. The number of times the divisor is contained in the result forms the second figure of the quotient. The operation is continued till all the figures of the dividend are used; the final result is the quotient sought. If the final remainder is 0, the division is said to be exact, or the dividend contains the divisor an exact number of times. Division of weights and measures or of money is known as compound division.

In Algebra, division is arranged under three heads:—First, the division of monomials, where, in order to get the co-efficient of the quotient, the co-efficient of the dividend is divided by the co-efficient of the divisor. After this, all the letters which enter the dividend and divisor are written, an exponent being given to each equal to the excess of its exponent in the dividend over that in the divisor. The result is the quotient sought. If the signs of the dividend and divisor are alike, the sign is *plus* (+); if they are unlike, it will be *minus* (−). The second division of algebraical division includes the division of a polynomial by a monomial. In this case each term of the polynomial is divided separately by the divisor. The algebraic sum of the separate results is the quotient. The third division is the division of polynomials. Both dividend and divisor are arranged with reference to the same leading letter. The first term on the left of the dividend is then divided by the first term on the left of the divisor, and the quotient forms the first term of the quotient. The divisor is then multiplied by the term of the quotient found, and the product subtracted from the dividend for the first remainder. The first remainder is then divided by the first term of the divisor for the second term of the quotient. The divisor is multiplied by this term of the quotient, and the product subtracted from the first remainder to make the second remainder. The operation is continued till a remainder is found whose first term is not exactly divisible by the first term of the divisor. The operation of the division of polynomials may sometimes be shortened by various methods. Among these may be mentioned *synthetic* division, which is applicable when the dividend and divisor are homogeneous, and contain only two letters. In the division of radicals, the process depends upon reducing the radicals to equivalent ones of the same degree. A number may also be divided by another by subtracting the logarithm of the divisor from the logarithm of the dividend: the number corresponding to the remainder in the logarithmic table is the quotient required.

DIVISOR, *div-i'-zor*, one of the factors of the Dividend—the factor by which the dividend is divided. Divisors of a number are those numbers by which it is exactly divisible. Thus, 1, 2, 3, 4, 6, and 12 are divisors of 12, because 12 may be divided by each of them without a remainder.

DIVI-DIVI. (*See* CÆSALPINIA.)

DOBCHICK, *dob'-tchik*. (*See* GREBE.)

DOCK, the common name for large, perennial herbaceous plants, forming a sub-species of the genus of Rumex (which *see*).

DODDER, *dod'-der*, a genus of plants (*Cuscuta*), regarded by some botanists as the type of a small distinct natural order *Cuscutaceæ*, of which there are about fifty known species, mostly natives of the warmer temperate regions. They are leafless climbing parasites, attaching themselves chiefly to leguminous plants, heath, hops, nettles, &c., by means of little rootlets. It resembles tangled catgut.

DODECAGON, *do-dek'-a-gon* (Gr., *dodeka*, twelve; *gonia*, an angle), a polygon which has twelve angles and twelve sides. When the angles and the sides are each of them equal, the dodecagon is a regular one, and may then be inscribed in or circumscribed by the circle, the sum of its interior angles equalling twenty right angles. (*See* REGULAR FIGURE.)

DODECAHEDRON, *do-de-kai-he'-dron* (Gr., *dodeka*, twelve; *edra*, a base), in Geometry, one of the five regular solids, being contained under a surface composed of twelve equal and regular polygons or bases. (*See* REGULAR BODY.)

DODO, *do'-do*, a genus of birds believed to be now extinct, but of whose existence within the last three centuries there is abundant evidence. When, in 1598, the island of Mauritius was discovered, the bird in question was plentiful and the sailors ate the flesh, which was much relished. It is described as being considerably larger than a swan, weighing sometimes fifty pounds, with a very bulky and heavy form. The bill was long and strong, depressed at the base, with a separate and much-arched apical portion, which was so sharp and strongly hooked at the tip that the dodo has been considered by some naturalists as approaching the predacious birds. The nostrils were placed on the sides of the depressed portion of the bill, which was covered by a naked skin; the face was similarly clothed. The feet, which were very short and stout, bore a considerable resemblance to those of the pigeon. The wings were also very short, and quite incapable of raising the bird in the air, even had they been furnished with the ordinary stiff quill-feathers; but, in place of these, they bore a few soft decomposed plumes like those of the ostrich and the teal, and were adorned with a tuft of similar but smaller feathers. This rudimentary condition of the wings led to the dodo's being placed among the cursorial birds by many writers. The general colour of the dodo was a blackish grey, but the plumes of the wings were of a light ash-colour. In Tradescant's catalogue ("Musæum Tradescantianum; or a collection of Rarities preserved at South Lambeth," by John Tradescant; London, 1656), we find, among the "whole birds, dodao, from the island Mauritius; is not able to flie, being so big." That this was a dodo there can be no doubt. Tradescant's stuffed specimen passed to the Ashmolean Museum at Oxford; but, being allowed to fall to decay, it was, by order of the curators, destroyed in 1755. Luckily, however, the head and one of the feet escaped destruction, and these, together with one other foot, safely stored in the British Museum, comprise the sole known remains of a creature commonly eaten within the last three hundred years.

DOG, *dog* (*Canis familiaris*), a genus of carnivorous quadrupeds. In all ages the *origin* of the domestic dog has been a question, and one most difficult of solution, with the most learned naturalists. Some are of opinion that the breed is derived from the wolf; others maintain that it is a familiarized jackal; all agree that no trace of it is to be found in a primitive state of nature. It is worthy of especial remark that the anatomy of the wolf, and its osteology in particular, does not differ from that of the dog in general more than the different kinds of dogs do from each other. The cranium is absolutely similar, and so are all, or nearly all, the other essential parts; and to strengthen still further the probability of their identity, the dog and the wolf will readily breed together, and their progeny is fertile. The obliquity of the position of the eyes in the wolf is one of the characters in which it differs from the dog. Another strong argument in favour of the identity of the dog and the wolf, is the fact that in both the period of gestation is the same—sixty-three days. The young of both wolf and dog are born blind, and see at the same, or about the same, time, namely, at the expiration of the tenth or twelfth day. A satisfactory classification of the different kinds of dog has not yet been arrived at. What some naturalists regard as types, others regard as mere mongrel races. It is hard to found a principle of arrangement; form does not afford it, neither does the character of the fur; kinds that are totally dissimilar associate as easily as those that are closely allied. One of the best arrangements is that made by Colonel Hamilton Smith, wherein the domestic dogs are grouped in six sections:—1, the Wolf-dogs, including the Siberian, Iceland, Esquimaux, Newfoundland, Nootka, sheep, great wolf, Great St. Bernard, Pomeranian dog, &c.; 2, Watch and Cattle dogs, including the German boar-hound, Danish dog, mâtin, dog of the North American Indians, &c.; 3, the Greyhounds, including the Brinjaree dog, different kinds of greyhound, Irish hound, lurcher, Egyptian street dog, &c.; 4, the Hounds, including the bloodhound, old Southern hound, staghound, foxhound, harrier, beagle, pointer, setter, spaniel, springer, cocker, Blenheim dog, water-dog, or poodle, &c.; 5, the Cur dogs, including the terrier and its allies; 6, the Mastiffs, including the different kinds of mastiffs, bull-dog, pug-dog, &c. (*See* various headings.)

DOG-BANE. (*See* APOCYNACEÆ.)

DOG-FISH (*Scyllinus catulus*), the common name of some of the smaller species of shark. The best known is the picked dog-fish, which is found in the European seas, and attains a length of about three feet. It belongs to the family *Spinacidæ*, of which one characteristic is the presence of a spine before the two dorsal fins. The body is long and tapering; the head flat; the snout conical; the teeth in both jaws sharp-edged, and formed for cutting. The tail fin is longer than it is broad. The upper parts are slate-grey, the under parts yellowish white. To use its spines offensively, the dog-fish bends itself into the form of a bow, and by a sudden motion causes them to spring asunder in an opposite direction. The dog-fish sometimes appear in prodigious numbers. They are said to afford the best food of any of the sharks, and are commonly brought to the markets of sea-side towns. The flesh is often dried. The liver yields oil, and the refuse parts are used as manure.

DOG-STAR. (*See* SIRIUS.)

DOG-WOOD BARK. (*See* CORNUS.)

DOG-GRASS. (*See* COUCH-GRASS.)

DOGWOOD, OR DOGBERRY, *dog'-wood*, a name commonly given to some of the arboreous and shrubby species of the genus *Cornus*. The common dogwood (*C. sanguinea*), a native of many parts of Europe and of the north of Africa, is a shrub averaging about 10 feet in height, with greenish-white flowers, with a disagreeable odour. The leaves become of a dark-red colour before falling off in autumn. The wood is very hard, and used for skewers, and formerly for arrows. The berries yield an oil which is used in France for lamps and in the manufacture of soap. The American dogwood (*C. Florida*) is a small tree, yielding excellent cross-grained timber, and the bark is used in medicine as a vermifuge. A powerful narcotic is obtained from the Jamaica dogwood. (*See* PISCIDIA.)

DOLERITE, *dol'-er-ite*, a mineral composed of felspar and anjike. It is a variety of greenstone.

DOLICHOS, *do'-li-kos*, a genus of plants of the order *Leguminosæ*, sub-order *Papilionaceæ*. There are many species, some shrubby, some annual, and some perennial. The flowers of some species are beautiful, and the seeds and young pods of others are cooked for the table.

DOLOMITE, *dol'-o-mite* (from Dolomieu, a French geologist), a crystalline variety of magnesian limestone, differing from the ordinary varieties, which are compact and amorphous. The crystalline structure is generally supposed to result from igneous influence.

DOLPHIN, *dol'-fin* (*delphinus*), a genus of *Cetacea*, and the type of a family *Delphinidæ*. It is usually from 6 to 8 feet in length, and bears a great resemblance to the porpoise, but has a much longer and sharper snout. The teeth in both jaws are nearly conical, though some of the species lose those of the upper jaw at an early age. They are very voracious, and are said to prey not only on fishes, medusæ, &c., but also on the wounded and feeble of their own species. They live, however, in herds, which often delight the voyager in the ocean solitude by the gambols which they perform around his ship. The common dolphin is found in the Mediterranean and in the North Atlantic Ocean. The French name is *Bec d'Oie*, goose-beak, or *Oie de Mere*, goose of the sea.

DONATI'S COMET, *do-na'-te*, a brilliant comet discovered at Florence by an Italian astronomer named Donati, early in June, 1858, when it was supposed to be nearly 230,000,000 of miles distant from the earth. It became visible to the naked eye in the beginning of the September following. It reached the point in its orbit nearest to the earth on October 10, when the diameter of its head appeared to be about 100,000 miles, and that of the nucleus 800 miles. When it first became visible without the aid of a telescope, its tail appeared to be 14,000,000 of miles in length. This gradually increased to 50,000,000 on October 10, but as it went away from the earth, the length of this part of the comet diminished with greater apparent rapidity than it had previously increased.

DONAX, *do'-nax*, a genus of molluscs, of the family *Tellinidæ*, with shells of two equal valves of a triangular form. The species, of which several are found on the British coasts, are generally small. Some fossils are found in the eocene formation.

DOOM PALM (*Hyphæne Thebaica*), a species of palms, natives of Upper Egypt and the central parts of Africa. It differs from most other palms in having a forked stem.

DOORNBOOM, or thorn-tree, a common tree in South Africa (*Acacia bronida*). It is about 30 feet high, and the timber is very useful.

DORADO, *do-ra'-do* (Fr., *dorade;* Sp., *dorado*, gilt, from *dorar*, to gild), in Astronomy, a constellation in the southern hemisphere, otherwise known as the Sword-fish. It lies in a direct line between the constellations Argo and Eridanus. Its largest star is of the third magnitude.

DORIS, *dor'-is*, a genus of naked marine mollusca of the order *Nudibranchiata*, somsetime known as sea-lemons. The body is oval, the abdomen flat; the back flat in some, and elevated in others; the mouth a small proboscis, with two small tentacula; the vent situated in the back, and surrounded by a circle of branched or plumed gills. They are plentiful on the coasts of Britain, where they may be found crawling on rocks, sea-weed, &c.

DORMOUSE, *dor'-mows* (from Lat., *dormio*, I sleep, and *mouse*), a genus of rodent quadrupeds (*Myoxis*) which is generally regarded as forming a connecting link between the *Muridæ* (rats, mice, &c.) and the *Sciuridæ* (squirrels, &c.). The chief characters by which the dormice are distinguished from the squirrels are derived from the structure of the skull, teeth, and intestine. The form of the skull resembles that of the mice, in being suddenly narrowed in the frontal region. There are four molar teeth on each side in each jaw; the upper jaw not possessing the anterior rudimentary fifth molar characteristic of the squirrels. The intestine is destitute of a cœcum, an organ which is of very large size in all other rodentia. The dormice have no cheek-pouches. The ears resemble those of mice. The body is about the size of that of the common mouse, but much plumper; the eyes large, black, and prominent; the tail between two and three inches in length, and more hairy at the top than elsewhere. With the exception of the throat, which is white, the dormouse is of a tawny-red colour. Dormice are found only in the temperate parts of the Old World, especially in Europe and Africa. In Asia they appear to be confined to the neighbourhood of the Caucasus. Only a single species, the common dormouse (*Myoxus avellanarius*), is found in Britain. It is extremely gentle and easily tamed, and feeds on beechmast, acorns, hazel-nuts, &c. It takes its food holding it in its hands, and sitting on its haunches like a squirrel (so do the rats), and often suspending itself by its hind feet, in which position it feeds as easily and comfortably as in the most ordinary position. Towards the winter it becomes exceedingly fat, and, having laid up a store of food, retires to its little nest, and coiling itself up into a ball, with the tail over the head and back, becomes completely torpid. There are two other beside the common dormouse—viz., the fat dormouse (*Myoxus glis*) and the garden dormouse (*Myoxus nitela*). The former is a large species, as big as a rat, and with a tail like a squirrel. It is a native of France and the south of Europe. The garden dormouse is smaller than the fat dormouse, and, breeding in gardens, is very destructive to wall and other fruit. It is a native of the temperate parts of Europe and Asia.

DORSAL, *dor'-sal* (Lat., *dorsalis*, from *dorsum*, the back), denotes something appertaining to the back, and in Anatomy it forms part of the name of ligaments, arteries, &c., belonging to that region.

DORSE, a fish of the same genus as the cod and haddock, found in the Baltic and other northern seas, but very rarely near the British coasts. It is generally about two feet in length. The flesh is much esteemed.

DORSTENIA, *dor-ste'-ne-a* (in honour of Theodore Dorsten, a German botanist), a genus of plants belonging to the natural order *Moraceæ*. The rhizomes and roots of several species have been supposed to be antidotes to the bites of venomous reptiles: those of *D. contrayerva* and *Braziliensis* have been employed in medicine for their stimulant, tonic, and diaphoretic properties.

DORY, OR JOHN DORY, *dor'-e*, a genus of fishes, of the family *Zeidæ*, a native of the Mediterranean, Northern, and Atlantic seas. Its name John Dory is probably derived from its French appellation, *jaune* (yellow) *dorée* (gilt). The British species (*Zeus faber*) is usually about eighteen inches in length, the general surface of the body is smooth and destitute of scales, but spiny scales or bony shields guard the dorsal and ventral edges. The anterior portions of the dorsal and oval fins are spiny, and very distinctly separated from the spineless portions. It is an extremely voracious fish, preying on small fishes and their spawn, as well as on the various kinds of crustacea and marine insects. It has an oval black spot on each side, and on this account shares with the haddock the traditionary repute of being the fish from whose mouth the tribute-money was taken by St. Peter, the impression of whose thumb and forefinger remained to record the event. Other species of the dory very similar to the European are found in the seas of other parts of the world.

DOSE, *dose* (Gr., *dosis*, from *didomi*, I give), is employed to denote a proper quantity of anything to be given or administered at one time, and is generally applied to medicines. A certain quantity, known as a full dose, is usually fixed upon as being suitable for a male from 15 to 40 years of age, diminishing proportionally for persons above or below that age. Besides age, there are frequently other circumstances to be taken into account; as the constitution, habits, &c., of the individual; and usually about one-fourth less should be given to an adult female than an adult male.

DOTTEREL, *dot'-tur-el* (*Charadrius morinellus*), a species of plover inhabiting the northern parts of Europe and Asia. The birds delight in high elevations. They are migratory, and appear in Britain on their northern migration, in spring, and on their southern migration, in the autumn. The length of the dotterel is about ten inches. Its plumage in summer is brown on the upper part; the cheeks, throat, and a band above the eyes, white; breast rusty red, with a white gorget on the upper part of it; a conspicuous black patch on the middle of the belly, and a few of the tail-feathers tipped with white. Its flesh is much esteemed, and the eggs are considered a great delicacy.

DOUBLE CONSCIOUSNESS, a mental condition arising from a morbid condition of the body, in which an individual is conscious of two independent trains of thought, and feels as if he were two persons at the same time. The cause of this strange phenomenon is probably to be sought in the alternate morbid activity of the two hemispheres of the brain. (*See* DUALITY.)

DOUBLE STARS, OR BINARY STARS.—In 1803, Sir William Herschel discovered the existence of sidereal systems composed of two stars, one revolving about the other, or both about a common centre. The stars are in some cases of different colours, the larger being red or orange, and the smaller blue or green.

DOUCHE. (*See* HYDROPATHY.)

DOUROUCOULI, *doo-roo-koo'-le*, a small monkey (*Nyctipitheus trivirgatus*) of Guiana and Brazil. It is about 9 inches long, with a very long tail, and is of a greyish white colour, with a brown line on its back and three dark stripes on the head. It resembles a cat more than a monkey, except in the hands; and the likeness is increased by bristly white hairs about the mouth. It is nocturnal in its habits and difficult to tame.

DOVE, *duv* (Sax., *daua*; Du., *duif*), a term sometimes extended, as the name pigeon also is, to the whole family of *Columbidæ*. (*See* PIGEON.)

DRACÆNA, *drai-se'-na* (from Gr., *drakaina*, a female dragon), a genus of plants belonging to the natural order *Liliaceæ*. The most remarkable species is *D. Draco*, the dragon-tree of Teneriffe, which attains a great size, and, unlike the majority of monocotyledonous trees, has forked branches. This plant yields a red resin, resembling dragon's blood. *D. terminalis*, the ti-plant, a native of the Sandwich Islands, has starchy roots, which are baked and eaten by the islanders; its juice is used for making a fermented beverage, and its leaves are employed as fodder for cattle.

DRACO, *drai'-ko* (Gr., *drakon*; Lat., *draco*, a dragon), a constellation in the northern hemisphere, between Ursa Minor, Cepheus, Cygnus, and Hercules. The largest star in this constellation is of the second magnitude. This star, known as γ *Draconis*, is the one which was used by Bradley when he discovered the aberration of light, to determine the coefficient of aberration of the fixed stars. (*See* ABERRATION.)

DRACONTIUM, *dra-kon'-ti-um*, a genus of plants of the natural order *Araceæ*. One species, *D. polyphyllum*, a native of tropical South America and also of India and Japan, is used as a medicine for asthma; and is thought to be efficacious as a remedy for snake-bite.

DRAGON, *drag'-on* (Greek, *drakon*, sharp-sighted), a term employed in modern Natural History to certain kinds of saurian reptiles. Some of these (the genus *Draco* of Linnæus) are furnished with a broad membranous lobe on each side. This is supported by the six first false ribs, which are extended straight outwards from the vertebral column. By the movement of these bones, the reptile is enabled to stretch its broad lateral membrane, which thus forms a sort of parachute, to support it in its long leaps from branch to branch. They, however, are quite destitute of any power to strike the air; so that their flight is nothing but a floating through space. As a rule, the species is harmless; there is, however, one, inhabiting the marshy plains of Guiana, and called the dragon-lizard, that bites severely if it should be handled. This creature has a long compressed tail, the back and tail crested, and the tongue forked, like that of a serpent; it sometimes attains a length of six feet. Both its flesh and eggs are eaten.

DRAGONET (*Callionymus*), a fish of the *Gobioidæ* family, inhabiting the Mediterranean and Northern Seas, remarkable for having the gill-opening reduced to a small hole on each side of the nape, and the ventral fins placed under the throat, separate and larger than the pectorals. The eyes are placed on the top of the head, looking upwards; the skin smooth and scaleless. The colours of the fish are yellow, blue, and white, making a beautiful appearance. There are three or four species; but that known with us as the gemmeous dragonet (*Callionymus*), and, by the Scotch, *gowdie*, is by far the most beautiful. All the species are about twelve inches long.

DRAGON-FLY (*Libellula*), a Linnæan genus of nedropterous insects, now constituting the family *Libellulidæ*, common in England, and to be seen in fine summer weather hawking about over the surface of ponds and rivers in search of insect prey. Their vulgar English name is "horse-stinger," which is no less inappropriate than ugly, as the insect possesses no means of annoying either horses or any other of the larger animals. hey are brilliant hues, love to bask in the suns ine, and prey on insects, They have strong horny mandibles and maxillæ, covered by the labrum and labium; their tarsi are three-pointed; their wings are equal; the posterior extremity of the abdomen is furnished with hooks or peculiar appendages. Their ferocity is so ungovernable, that when taken and imprisoned, they have been known to devour their own bodies. The great dragon-fly (*Æshna grandis*) is about four inches long, and the largest of the British species. It has been seen to dart upon a large cabbage butterfly, and to bite off the wings and devour the entire body in less than a minute. In the larva state, the *Libellulidæ* live entirely in the water, engaged in unceasing strife with other insects, for whose capture and destruction it possesses ample means, through a singular contrivance of its lower lip. This consists of two principal pieces, one of which is articulated to the head, whilst the second is attached to its extremity. At the apex of this second piece, two jaw-like organs are articulated. In repose this lip is folded beneath the head, but can be immediately extended to a considerable distance in front of the head, so as to seize any minute insects or small fishes that may pass before it. The respiration of the larvæ of some of these insects is singularly contrived. They are provided with the means of drawing water into their bodies to supply air for respiration, and expel it again by the same orifice at the extremity of the abdomen, with such force, that they thus propel themselves through the water, whilst their legs are at rest. The hooks at the extremity of the abdomen of the dragon-fly render the creature essential service at the period of transformation. Crawling out of the water, it attaches itself by these hooks to a stick or rush, and struggles out of the pupa-case. At first its body is quite soft and moist, and the wings folded up into a small compass. In a few hours, however, the wings are capable of expansion, and the body assumes a proper consistency. Dragon-flies abound most in warm climates, but are met with in very northern regions.

DRAGON ROOT, a plant (*Arisæma atro-rubens*), of the natural order *Araceæ*, a native of North America. The tube supplies a stimulant applied externally as a remedy for bronchitis, asthma, and rheumatism, and powders and ointments are also made from it.

DRAGON-TREE. (*See* DRACÆNA.)

DRAGON'S BLOOD. (*See* CALAMUS, PTEROCARAUS.)

DRASTICS, *dras'-tix* (Gr., *drastikos*, active, brisk, from *drao*, I effect), is a term generally applied to such medicines as are very violent in their action, particularly as purgatives; such as croton oil, jalap, &c.

DRAUGHT (Lat., *haustus*, a gulp, or one drink), is a liquid form of medicine intended to be taken at once, or at a draught; whence its name.

DREAMS, *dreems* (Du., *droom*; Ger., *traum*), are defined to be "trains of ideas presenting themselves to the mind during sleep." It frequently, if not always happens during sleep, that while some of the mental faculties are suspended, others are still active, and are busy with numerous ideas which succeed each other with more or less regularity. This is dreaming. It is characterized by an absence of consciousness with regard to external things, and an entire suspension of voluntary control over the current of thought, so that the principle of suggestion—one thought calling up another according to the laws of association—has unlimited operation. The balance of the mind, the mutually controlling influence of the mental faculties is disturbed, some being active, while others are dormant, and the reasoning powers are not exercised to test and harmonize the perceptions. The mind is in fact temporarily "like sweet bells jangled, harsh and out of tune," restored to healthy action when all the faculties are alike awake. One of the most remarkable features of dreaming is the rapidity with which the mind passes through a long series of events. Whole years may seem to the dreamer to have elapsed, and a multitude of images may have been successively piled up before him, though the time occupied therewith is known to have occupied only a few minutes, or even a few seconds. Many of those unpleasant dreams that are sometimes found to precede illness are doubtless occasioned by feelings or sensations of which in the ordinary waking state we are unconscious. It is in this way that indigestion is so fruitful a cause of unpleasant dreams. Of the five senses, touch is the most excitable during sleep, and most frequently modifies the character of our dreams. The sense of hearing is the next; and the least excitable of all our senses is that of sight. Our belief in the reality of the scenes brought before us, and in the presence of external objects not before us, are among the most curious and important of the phenomena of dreams. Everything seems real and vivid before us. Sometimes a particular dream will remain, as it were, latent in the mind, and be revived at a future period; and when the dreamer awakes, he has a consciousness that the dream he has just experienced is a continuation of a dream he had, perhaps, years before. This affords one of the obscure problems connected with memory which seems to defy solution.

DREISSENA, *dre-is'-se-na*, a genus of molluscs generally regarded as belonging to the Mussel family, from which, however, it differs in some particulars. *D. polymorpha*, a native of Western Asia, has recently appeared in the rivers and canals of Germany, Holland, and England.

DRIFT, *drift* (Dan., *drift*), in Geology, a term signifying "that which is driven;" as *drift-wood*, wood carried down by rivers, and driven by tides and currents to distant shores; *sand-drift*, sand driven and accumulated by the wind. The word is often used as an abbreviated term for the Glacial Drift of the Pleistocene period. (*See* GLACIAL DEPOSITS.)

DRILL, a species of baboon (*Cynocephalus leucophæus*), similar to the mandrill; but smaller and less ferocious. It is a native of Guinea.

DRIMYS, *dri'-mys* (Gr., *drimus*, acrid), a genus of plants belonging to the natural order *Magnoliaceæ*. The bark which is commonly known under the name of Winter's bark, is obtained from a species of this genus, namely, *D. Winteri*, or *aromatica*. It was first brought to Europe by Captain Winter, after a voyage to the Straits of Magellan, in 1579, and was formerly much used as a substitute for cinnamon, having similar aromatic and stimulant properties: at present it is rarely employed.

DROMEDARY. (*See* CAMEL.)

DROMIA, *dro'-me-a*, a genus of crustacea, of which the sponge-crab (*Dromia vulgaris*) may be taken as the type. The sponge-crab is furnished with two sharp curved claws, which enable it to hold fast to pieces of sponge, medusæ, &c.

DRONE. (*See* BEE.)

DROPSY, *drop'-se* (Gr., *hudrops*, from *hudor*, water, and *ops*, aspect or appearance), a disease characterized by the accumulation of a watery fluid in one or more of the shut cavities of the body, or in the areolar tissue, or in both, independent of inflammation. In a state of health, the capillaries, which ramify every part of the body, constantly pour out upon every surface, into the most minute cells as well as the great cavities, a watery fluid to moisten the parts, and thereby facilitate motion and prevent injury from friction. This watery fluid is speedily taken up by another class of vessels, called the *absorbents*, which carry it back to the general circulation. When the healthy condition of these organs is impaired, either from the exhalents acting too powerfully, or from the absorbents being deficient in action, an accumulation of fluid takes place, either in the general cellular membrane or in the natural cavities of the body. Dropsy is either active or passive. Active or acute dropsy is owing to excessive action of the exhalents, in consequence of increased action of the heart; it comes on suddenly and tumultuously, and sometimes can scarcely be discriminated from inflammation with serous effusion. It is induced by various causes; as exposure to a cold moist atmosphere, particularly when the body is in a state of perspiration from active exercise or long exposure to heat. Chronic or passive dropsies are occasioned by defective absorption, arising, in some measure perhaps, from an enfeebled state of the absorbents, strictly and anatomically so called, but more frequently, chiefly, and in some cases entirely, from undue fulness of the veins; this venous repletion being produced almost always by some impediment to the free return of the blood to the heart; as tumours pressing on the great blood-vessels, ossification of the valves of the heart, &c. When the veins are distended to a certain degree with watery fluid, the entrance of more of the same fluid through their sides is impeded or prevented; and when the distension is still greater, the aqueous part of the blood may even pass in the other direction out of the vessel. The difference between active and passive dropsy is chiefly in the rate at which the collection augments; in the one case the liquid is rapidly effused in quantity much beyond the natural amount of exhalation, in the other the exhalation goes on as usual, but the fluid exhaled is not taken back again into the circulating vessels with sufficient facility. In the treatment of this disease, the first object is to get rid of the preternatural accumulation of watery fluid; the second, to prevent its collecting again: for dropsy is generally a symptom or sequence of other disorders, and rarely a disease of itself. In general, the object is to augment the discharge of watery fluid from one or more of the secreting surfaces of the body. In some cases it is best to seek to promote this discharge by way of the kidneys; in others, by the mucous lining of the alimentary canal; in others, by the external skin. Sometimes great present relief is afforded to the patient by tapping; but it is generally only temporary, and can only sometimes be resorted to.

DROPWORT. (*See* SPIRÆA.)

DROSERACEÆ, *dros-e-rai'-se-e* (Gr., *droseros*, dewy), the Sun-dew family, a natural order of dicotyledonous plants in the sub-class *Thalamifloræ*. They are bog or marsh plants, and are found in almost all parts of the world with the exception of the Arctic regions. They possess slightly acid and acrid properties. The typical genus is *Drosera*, the sun-dew, the species of which are interesting, from the peculiar irritability of the hairs on their leaves. The plant commonly known as Venus's fly-trap is a species of *Dionæa*, another genus of this order, and exhibits in a most striking manner this irritability. (*See* DIONÆA.) Some of the sun-dews communicate a beautiful purple stain to the paper upon which they are dried, and also yield a yellow colour when treated with ammonia.

DROWNING, *drown'-ing* (Dan., *drugner*, to drown), is suffocation produced by the immersion of the body under water, or, according to some, by the exclusion of atmospheric air from the lungs by any liquid. The necessity of air to life is well known, and any exclusion of it, for even a few minutes, produces death. When a human being unable to swim falls into the water, if it is not of great depth, he first goes to the bottom; but on account of the air in the lungs rendering the specific gravity of the body lighter than the water, he immediately rises again to the surface. The efforts made by him to maintain himself at the surface diminish the quantity of air in the lungs, and he again sinks to the bottom, but soon rises again; and this alternate rising and sinking may occur several times in succession. The air which is expelled from the lungs is seen to rise to the surface in the form of bubbles, and with every expiration the specific gravity of the body is increased; the powers of sensation and voluntary motion rapidly diminish, and the body settles at the bottom. A feeble motion may still be perceived in the chest for a short time, but that, too, ceases, and death ensues. In drowning, death is effected by the impure condition of the blood. The impure or venous blood of the system is constantly being carried to the lungs, where, being brought into contact with the air, its impurities are carried off, and it is converted into pure or arterial blood. When, by any means, as in drowning, the lungs are shut out from communication with the external air, this operation cannot be carried on, impure instead of pure blood is carried through the system, the brain is immediately affected, sensation and volition rapidly diminish, and at length cease. (*See* ASPHYXIA.) The period during which life may continue in submersion varies in different persons. In some instances bodies submerged but one minute have been found to be lifeless; but in many cases recovery has taken place after a submersion of eight or even ten minutes. Occasionally, animation has been restored after a submersion of fifteen or twenty minutes, or even of half-an-hour. In general, if the body has not been in the water longer than from five to eight minutes, the prompt use of the proper means will restore animation. The following plan of treating a drowned person was proposed by the late Dr. Marshall Hall in 1856:—Treat the patient instantly, on the spot, in the open air, except in severe weather, freely exposing the face, neck, and chest to the breeze; send with all speed for medical aid and for articles of clothing, blankets, &c.; place the patient gently on the face, with one arm under the forehead, so that any fluids may flow from the throat and mouth, and without loss of time; *to excite respiration*, turn the patient on his side, and apply snuff or other irritant to the nostrils; dash cold water on the face, previously rubbed briskly until it is warm. If there be no success, again lose no time, but, *to imitate respiration*, replace the patient on his face (when the tongue will then fall forward, and leave the entrance into the windpipe free); then turn the body gently, but completely, on the side and a little beyond (when *in*spiration will occur), and then on the face, making gentle pressure along the back, when *ex*piration will take place, alternately. These measures must be repeated deliberately, efficiently, and perseveringly, fifteen times in the minute only. Meanwhile, *to induce circulation and warmth*, continuing these measures, rub the limbs *upwards* with firm pressure and with energy, using handkerchiefs, &c., for towels; replace the patient's wet clothing by such other covering as can be instantly procured, each bystander supplying a coat, waistcoat, &c.

DRUPACEÆ. (*See* AMYGDALEÆ.)

DRUPE, *droop* (Lat., *drupæ*), a succulent fruit containing a single seed, or kernel, usually enclosed in a hard covering, and commonly called a stone-fruit. Examples occur in the peach, apricot, plum, and cherry. A number of drupes aggregated together on a common receptacle form the raspberry and similar fruits.

DRY ROT, the name given to the decay of timber, proceeding from the fermentation of sap that is left in the wood, and which is brought about by the influence of warmth, combined with a certain degree of moisture and the want of proper ventilation. It appears in timber that has not been properly seasoned, or which has been cut in the spring of the year, when the sap is rising, as in the case of oak trees, which are cut at this time for the sake of the bark. When the sap has fermented, the vegetation of fungi follows, which spreads through the wood, destroying the fibres to such an extent that they crumble into dust under any slight pressure. To prevent dry rot in timber, it is necessary that it should be well seasoned, and that the air should at all times have free access to it. Various methods have been adopted for filling the pores of the wood with some solution, to render it proof against destruction by dry rot, among which may be mentioned Sir William Burnett's process, by which the wood is soaked in a solution of chloride of zinc; Mr. Bethell's use of creasote, and that of Kyan (*see* KYANISING), by which the pores of the timber are filled with a solution of bichloride of mercury, forced into them by the air-pump.

DRYOBALANOPS, *dri-o-bal'-a-nops* (Gr., *drus*, oak; *balanos*, acorn; *ops*, aspect), in Botany, a genus of plants belonging to the natural order *Dipteraceæ*. The species *D. aromatica* or *camphora* is a large tree found in Sumatra and Borneo. From its stem a liquid called liquid camphor, and a crystalline solid substance named Sumatra camphor, are obtained. (*See* CAMPHOR.)

DRYOPHIS, *dri'-o-fis*, a genus of serpents, of the family *Colubridæ*, natives of India, Madagascar, and tropical America. They are long and slender, and live mostly among the branches of trees. They are marked by a peculiar prolongation of the upper jaw, which sometimes is shaped like a leaf.

DUCHAI HEMP. (*See* ÆSCHYNOMENE.)

DUCK, *duk* (Ang.-Sax.; Lat., *anas*).—The group to which the name of duck is generally extended is characterized by greater breadth of bill than either swans or geese. Their food is chiefly animal, whilst that of both swans and geese is in great part vegetable. A well-known example of this family is the wild duck, or common mallard (*Anas Boschas*), the original of all the ordinary domestic varieties. It is found in all the countries of Europe, but abounds especially in the northern parts. It is nearly two feet in length, three feet in extent of wings, and weighs about three pounds. The bill is of a greenish-yellow colour; the head and upper part of the neck of a glossy green, terminated in the middle of the neck by a white collar. The scapulars are white, barred with fine brown lines; the back is brown, and the rump black, shaded with green. The lower part of the neck and breast is of a chestnut-colour; the belly pale grey, barred with dusky bars. The legs are orange-yellow. Like the rest of the duck tribe, the mallards quit the north at the end of autumn, and, migrating southward, arrive at the beginning of winter in large flocks, and spread themselves over the marshy wastes of Britain. In bygone times, when the tracts of marsh land in England were much more extensive than now, the mallard was among the commonest of our wild-fowl; and even now our fen countries are patronized by them in such vast numbers as to keep the London market fully supplied in the season. The extreme wariness of these birds renders necessary much patience and ingenuity in obtaining large quantites of them. They fly at a considerable height in the air, in the shape of a wedge or triangle; before they alight on any spot, they take several wheels in the air, as though to reconnitre, and then descend with extreme precaution. When at rest on the water, they take care to keep at a considerable distance from the shore, and when they compose themselves for sleep, some of the company are always awake to keep guard and to apprise the remainder of the approach of danger. They are much more active by night than by day. The wild duck usually makes her nest amongst the tall grass or rushes skirting the water; but instances have occurred of the birds building in trees. The food of the duck consists of worms, mollusca, and aquatic insects, which they separate from the mud by the agency of lamellæ at the margins of the bill. In his first division of true ducks, Mr. Yarrell includes the sheldrake, Muscovy duck, wild duck, gadwell, shoveller, pintail, widgeon, bimaculated duck, garganey, and teal; accounts of all of which will be found in their proper places. The domestic duck is duller of plumage and less graceful in form than the wild. The most obvious distinction between them, however, lies in the colour of their feet; those of the wild ducks being yellow, and the tame ducks black. The tame duck does not, like the wild, pair and remain with one mate, but takes the control of an entire troop of hens. Whatever its species may be, the tame duck is a desirable bird to have in a poultry-yard. Nor is water indispensable to its existence; so far from it, indeed, that, instead of being absolutely necessary, it is often injurious to the young; in fact, they should never be allowed to swim till more than a month old. Instead of allowing young ducks to go out in the morning to eat slugs and worms, they should be shut up, since this food, notwithstanding their partiality for it, is injurious. They lay a great number of eggs, require very little attention, and, with respect to ducklings, they may be easily fattened in the course of a month with any kind of pulse, or grain and water.

DUCKBILL, ORNITHORHYNCHUS, OR PLATYPUS, *duk'-bil*, a genus of mammalia, order *Monotremata*. Only one species is fully ascertained (*O. paradoxus*, or *panatinus*), generally known as the water-mole in the Australian colonies. The entire length of the animal, including bill and tail, is about two feet; body long and compressed, and thickly covered with very glossy hair, at the roots of which is a layer of waterproof felt-like material. The head is round and small, eyes small and bright, no external ear, and instead of the muzzle, mouth, and teeth of an ordinary quadruped, the creature is furnished with a bill like that of a duck (but broader in proportion), and possessing small transverse laminæ like the duck's bill. The legs are short; the fore feet have each five toes, with strong burrowing claws and a connecting membrane for swimming. The hind feet are likewise webbed, but the web does not extend beyond the base of the claws. The tail is strong, broad, and flattened, about half as long as the body, covered with longer and coarser hairs, and nearly naked on its under surface. It lives chiefly in the water, and, like the duck, seeks its food among the mud. Its burrowing powers are said to exceed those of any other animal, fifty feet being no very uncommon length for it to run. It is wary and active, and by no means easily shot. Its voice resembles that of a young puppy.

DUCKWEED, *duk'-weede*, a genus of plants, *Lemna*, consisting chiefly of floating flat green fronds, with roots hanging loosely in the water. They are found in nearly all parts of the world.

DUCT, *dukt* (Lat., *duco*, I lead or conduct), denotes generally any tube or canal by which a fluid is conducted or conveyed. It is especially used in anatomy and botany.

DUCT, ALIMENTARY. (*See* ALIMENTARY CANAL.)

DUCTILITY, *duk-til'-e-te* (Lat., *ductilis*, from *duco*, I lead, draw), the power possessed by certain bodies, and especially the metals, in virtue of which they are capable of being drawn out in length, while their diameter is diminished, without fracture or separation. Among the metals it may be called the property of being able to be drawn out into wires. The order of the metals which are ductile is almost similar to the order of those which are malleable; it is as follows:—

Gold, silver, platinum, iron, copper, zinc, tin, lead, nickel, palladium, cadmium. Glass is exceedingly ductile at a high temperature, and can be drawn into flexible threads finer than any hair. The property is also possessed by other substances; such as gums, glues, resins, &c., when softened by moisture or heat.

DUDLEY LIMESTONE.—A Silurian limestone, very rich in fossils, belonging to the Wenlock series, and very abundant near the town of Dudley, in Worcestershire.

DUGONG, *du'-gong-* (*Halicore Dugong*), a marine animal belonging to the family *Manatidæ* or herbivorous cetacea. Its length varies from twelve to twenty feet. It feeds on the algæ which grow on submarine rocks in shallow seas. Its affection for the young is remarkable; and if the latter can be surprised and captured, the mother may be easily taken. It's flesh is eaten, and said to resemble beef in texture and flavour. It is found among the islands of the Indian archipelago. The osteology of the dugong exhibits some remarkable points of correspondence with that of pachydermatus animals.

DUGUETIA, *du-gu-e'-she-a*, a genus of plants belonging to the natural order *Anonaceæ*. The only interesting species is *D. quitarensis*, a native of Guiana, which furnishes the strong, elastic wood called lance-wood. This is chiefly used by coachmakers.

DULCAMARA. (*See* SOLANUM.)

DULSE. (*See* RHODOMINIA.)

DUMB. (*See* DEAF AND DUMB.)

DUMB CANE, the popular name of a plant (*Dieffenbachia seguina*) of the natural order *Araceæ*, and a native of the West Indies. The juice produces a most painful swelling of the tongue which renders speech impossible; hence the name given. The juice is sometimes used in the manufacture of sugar; and a decoction of the stem is used as a fomentation to relieve dropsy.

DUNES, *dunes* (Celt., *dun*, a hill, whence Fr., *dunes*; Ger., *dünen*; Du., *duynen*), the name given to low and almost barren hills of sand of great breadth, that extend along the coast of Holland, Belgium, and the northern departments of France, and serve to protect the fertile land within them from the inroads of the ocean. They have been formed by the wind blowing great quantities of sand inland whenever it sets dead on shore. A few kinds of grass, such as the *Carex arenaria* or sea-carex, the *Festuca rubra* or creeping fescue-grass, and the *Arundo arenaria* or sea-reed, grow on these sand-banks, and are of material benefit in binding the loose surface together. These sand-hillocks are to be found on the coasts of Brittany and Gascony and parts of Spain; they also exist on the north coast of Norfolk, where they are called *denes*.

DUNG-BEETLE, *dung-be'-tl* (Ang.-Sax.), the name of certain of the *Scarabæides*, living for the most part on or in the dung of other animals. They are scientifically known as *Coprophagi* (Gr., dung-eaters). For the most part they are black, or black and brown, and some few are adorned with brilliant metallic colours. To this section belongs the sacred beetle of the Egyptians. This species is not only found in Egypt, but is met with in the south of Spain, France, and Italy, and, as well as other species of the group to which it belongs, incloses its eggs in a ball of excrement, which it forms by rolling the substance by means of its hind-legs. The size of the ball, when completed, is much larger than the insect, being sometimes as much as an inch and a half in diameter. The dor, or shard-born beetle (*Geotrupes stercorarius*), belongs to this tribe, and is one of the commonest of British beetles. It is of a stout form; less than an inch long; black, with metallic and blue reflexions on the under surface. This species may often be heard droning through the air of a summer evening. It is almost impossible to over estimate the great good performed by these insects. Not only do they hasten the removal from the ground of what becomes more offensive the longer it stays, but they carry the offensive matter to where plants grow, and, by distributing it in the soil, materially assist their proper growth.

DUODENUM, *do-o-de'-num* (Lat., *duodenus*, consisting of twelve), the first portion of the small intestine, so called by the ancients because it was supposed not to exceed the breadth of twelve fingers; but as they dissected only animals, this does not hold true in the human subject. It is in this intestine that chylification of the food takes place. (*See* DIGESTION.)

DUPLICATION OF THE CUBE. (*See* CUBE.)

DURA MATER. (*See* BRAIN.)

DURAMEN, *du-rai'-men* (from Lat., *durus*, hard), the heart-wood or central portion of an exogenous stem. It is made up of wood cells with thickened sides, and which are impermeable to fluids, hard in texture, coloured, and of a dry nature. (*See* ALBURNUM.)

DURIAN. (*See* DURIO.)

DURIO, *du'-re-o* (from Malay, *dury*, thorny), in Botany, a genus of plants belonging to the natural order *Sterculiaceæ*. The species *D. zibethinus* yields the fruit called the durian, which is highly esteemed in the south-eastern parts of Asia. It is about six inches in diameter, with a thick rind, covered with short spines. It has, however, a strong smell, which renders it disagreeable at first to those unaccustomed to it; but the dislike to this smell is generally soon overcome.

DURRA. (*See* HOLCUS.)

DURRA, OR DAIRA GRASS, *doo'-ra*, also known as Indian Millet, or Sorgho Grass, a genus of grasses, several species of which are cultivated in Asia and Africa as corn-plants. The species are annual, with broad leaves, and a juicy saccharine pith. One species, *Sorghum vulgare*, is cultivated in some of the warmer parts of Europe. Another species, the sugar-grass (*S. saccharum*), is grown in America, and known as the Chinese sugar-cane, and yields large quantities of sugar.

DUSICYON, *du-si'-se-on*, a genus of *Canidæ*, including many species of American dogs, sometimes known as Agerara dogs. They have a fox-like aspect, live in burrows, and feed on birds and smal quadrupeds.

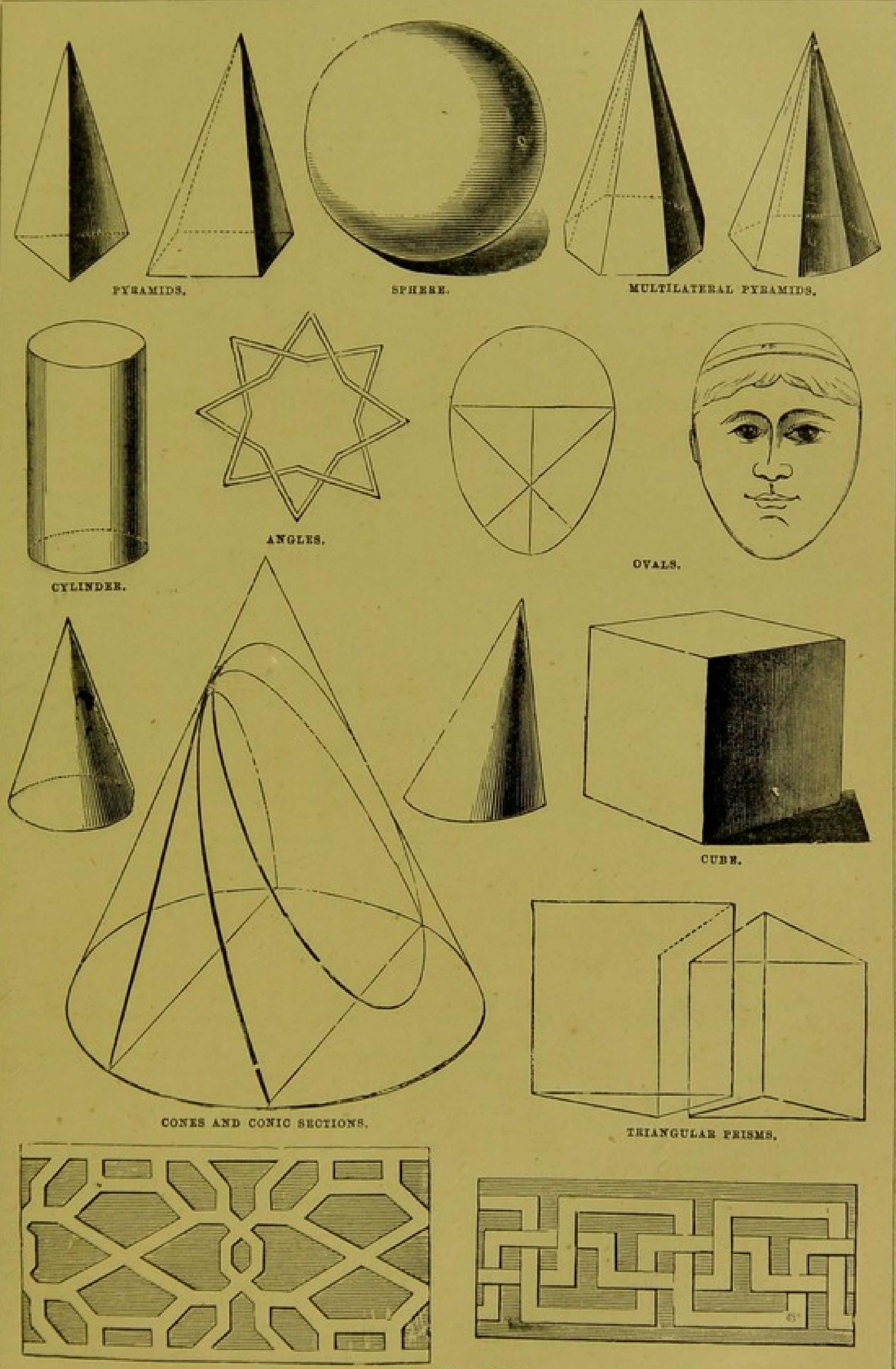
DUST, ATMOSPHERIC, *dust*.—When a ray of sun-light enters a partially-darkened apartment through any small aperture or chink in the shutters, or when a flood of intensely-brilliant light from the same source pours into a room, we can distinctly see small particles of various substances, familiarly called motes, floating about in the track of the sunbeam, and moving with greater or less rapidity according to the extent to which the air is agitated in which they are suspended. Under ordinary circumstances, these motes, or atmospheric dust, are invisible to human sight, being so minute that they can only be seen under the conditions that have been mentioned, through the reflection of strong sunlight from their surface, or by the aid of a powerful microscope. But whether they are visible to us or not, they are always present in the atmosphere that we breathe ; and it is considered that the lower strata of the air immediately in contact with and above the surface of the earth are constantly impregnated with these small particles, of unappreciable weight and size, that are fragments of various organic and inorganic substances that have been worn away from the bodies of which they originally formed a part, by friction and other causes. It has been discovered by Professor Ehrenberg, of Berlin, that the particles carried about by the wind, when submitted to chemical tests, consists of minute fragments of all kinds of mineral substances, mixed with mould and various organic bodies. Professor Tyndall asserts that the atoms frequently contain the germs of infectious diseases.

DYKE, In Geology, a term applied to any wall-like mass of igneous rock filling up a fissure in other rocks. A dyke may come up through any king of previously existing rock, whether igneous or aqueous. When the matter of the dyke is harder than the intersected strata, and these have been subjected to waste and denudation, the igneous wall-like mass may be traced for miles across a country; and, on the other hand, where the rock-matter of the dyke has been softer, its course may also be traced by narrow wall-sided fissures and linear ditch-like depressions.

DYNAMICS, *di-nam'-iks* (Gr., *dunamis*, power), that division of mathematics which treats of force, considered as producing motion in bodies. Force may be defined as any cause which changes, or tends to change, a body's state of rest or motion. The case of force tending to move bodies from rest will be found under the subject of Statics. The case of force actually producing motion, or changing motion, belongs to Dynamics. Some of the most distinguished philosophers have given much time and labour to the investigation of this branch of mathematics. Among these may be mentioned Newton, Huygens, Euler, D'Alembert, Poinsot, and others. The doctrine of dynamics is divided into several distinct heads. First, the names and definitions of the various terms employed; such as force, velocity, accumulating velocity, moving velocity, motion, accumulating motion, &c. The second branch of dynamics treats of the movement of points, and is divided into two classes of problems—direct and inverse. In the first case the path of a point is determined when the forces acting upon it are given ; and in the second case the force or forces acting upon a point are determined when the path of the point is given. In the third branch of dynamics the motion of a rigid system of points or a solid body is treated of. D'Alembert first laid down the general method for treating problems in rigid dynamics. Motions of rotation are treated of in the fourth branch of dynamics. The three laws of motion upon which most of the problems in dynamics depend are as follows :—First, a body under the action of no external force will remain at rest, or move uniformly in a straight line. Second, when any number of forces act upon a body in motion, each produces its whole effect in altering the magnitude and direction of the body's velocity, as if it acted singly on the body at rest. Third, when pressure produces motion in a body, the momentum generated in a unit of time, supposing the pressure constant, or which would be generated supposing the pressure variable, is proportional to the pressure. (*See* CENTRAL FORCES, FORCE, PERCUSSION, PROJECTILES.)

DYSENTERY, *dis'-en-ter-e* (Gr., *dusenteria*, from *dus*, with difficulty, and *enteron*, intestine), is a disease characterized by frequent mucous or bloody discharge, attended with griping pains in the abdomen, straining, and tenesmus. Dysentery consists essentially in inflammation of the mucous membrane of the large intestines, and, in the acute form or stage of the disease, is attended with fever. Dysentery is one of the pests of hot climates, and in all tropical countries, at certain seasons of the year, it is very prevalent and destructive. It is, however, among fleets and armies that this malady most displays its deadly power; so that it has been termed the " scourge of armies and the most fatal of all their diseases." At one time it was very prevalent in this country ; but now it is not a very common nor a very serious disorder here. The forms of this disease and the circumstances under which it prevails are infinitely various, and many speculations have been formed regarding it. It has been ascribed to exposure to wet and cold, to the use of unwholesome food, to the agency of malaria, to contagion. Generally the most violent forms of this disease occur in warm climates and in situations where the body is exposed to extreme alternations of heat and cold ; and hence there is every reason to believe that these influences are largely concerned in its production. The patient passes sleepless or dreamy and disturbed nights, and is low-spirited and desponding. The duration of this disease is very various. In some cases it may prove fatal in a few days, or even hours; in others it may last for weeks or months. Two stages are recognised of this disease—the inflammatory and that of ulceration.

DYSPEPSIA, *dis-pep'-se-a* (Gr., *duspepsia*, from *dus*, bad, and *pepto*, I concoct or digest), a bad or difficult digestion. It is by means of digestion that the food which is taken into the stomach is converted into nutritive matter for supplying the waste that is constantly going on in the system; hence anything that interferes with the due supply of nutritive matter materially affects the system, and may introduce a long series of ill. (*See* DIGESTION.) Among the innumerable disorders in more distant parts that are produced by dyspepsia are palpitations of the heart, irregularities of the pulse, asthma, pain in the head, with the loss of mental energy, and some confusion of thought. One of the worst of the occasional concomitants of dyspepsia is that state of mind which is known as hypochondriasis. There is languor, listlessness, or want of resolution, with an apprehension of some great evil in the future. Such persons are particularly attentive to the state of their own health,



PYRAMIDS. SPHERE. MULTILATERAL PYRAMIDS.

CYLINDER. ANGLES. OVALS.

CUBE.

CONES AND CONIC SECTIONS. TRIANGULAR PRISMS.

GEOMETRIC ORNAMENTS.

DRAWING.

and, from any unusual feeling, perhaps of the slightest kind, they apprehend great danger, or even death itself. Of the causes that induce dyspepsia, are indigestion, noxious or irritating substances taken into the stomach as food or drink—such as tainted meat, decayed vegetables, unripe fruit, very acid matters, alcoholic liquors, &c.; and even wholesome food taken too frequently, or in too large a quantity, especially when its nature is very nutritious or in a very concentrated form, or rendered too stimulating by being highly seasoned. The abuse of fermented and spirituous liquors is one of the most frequent causes of dyspepsia; and the consumption of large quantities of fluids, particularly during meals, is very injurious. Among the more remote causes of dyspepsia, or those which affect the stomach through other organs, are want of exercise or of pure air, intense study, or too close application to business, strong mental emotion, or exposure to a cold or moist atmosphere. In the treatment of dyspepsia it is to be borne in mind that it is not so much medicines that will remove the present discomfort that are required, as a discontinuance of those habits which have generated the discomfort. Hence one great and indispensable principle in the treatment of dyspepsia is that of restricting the quantity of food taken at any one time. The amount of food introduced into the stomach should be kept within the limits of its capacities and powers. Another very important principle is, that the stomach should have time to perform one task before another is imposed upon it. Animal food, with a moderate portion of thoroughly-cooked vegetables, is, perhaps, the diet best suited for a feeble stomach. As regards the use of spirituous or fermented liquors, in the opinion of Dr. Watson—though some allowance must, no doubt, be made for custom—most dyspeptic persons would be better without any of these drinks. Finally, change of air, change of scene, change of society, usually exert a very beneficial effect in this disorder.

DYSODIL, *dis'-o-dil*, a laminated bituminous mineral, of a yellow or greyish colour, often found in connection with lignite. It burns with a bright flame and gives out a very disagreeable odour.

DYSPNŒA, *disp-ne'-a* (Gr., *dus*, with difficulty, and *pneo*, I breathe), is an embarrassed or laborious breathing. It is owing to a disturbance of the natural and healthy relation that ought to subsist between the quantities of blood and air in the lungs. When the quantity of atmospheric air that reaches the lungs is by any means diminished, or when there is more venous blood sent to the lungs than can be arterialized under the ordinary modes of inspiration, then instinctive efforts are made to increase the quantity of air by increasing the number of acts of inspiration. Hence dyspnœa may arise from a number of causes; as croup or laryngitis, diminishing the only inlet for the air; pressure upon the lung, or any other means by which its size is diminished, or it is rendered less spongy; or by increased action of the heart.

DYTISCUS, *di-tis'-kus*, a genus of aquatic coleopterus insects, or water-beetles, forming the family *Dystiscidæ*. They are generally oval in form, with smooth surfaces. A common British species, *D. marginalis*, is about an inch and a quarter in length, of an olive colour, marked with yellow. All the species are very voracious, and boldly attack creatures larger than themselves. They become very tame in a fresh water aquarium, and will receive food, worms, &c., from the hand. They live in marshes and ditches, but can fly well. The larvæ hide themselves in the earth before changing to the pupæ state.

DZIGGETHAI, or DJIGGETAI, *jig'-ge-ti*, a quadruped (*Egnus Hemoionus*) known also as the Khur or Goor, resembling in appearance both the horse and the ass, and therefore named by the Greeks, *hemionus*, half-ass. It is a native of the steppes of Tartary. It is like the horse in size, gracefulness, and neighing. It lives in herds, and is fleet and shy, so that it is hunted with great difficulty by the Tungûs and Mongols, who consider its flesh a delicacy. The animal has been domesticated, but does not breed except in a wild state.

E.

EAGLE, *e'-gl* (Fr., *aigle;* Lat., *aquila*), a genus of birds of prey, constituting the largest of the *Falconidæ*. In these birds the bill is of moderate length, with the ridge of the upper mandible straight from the base, at least as far as the end of the cere, beyond which it is decurved; the lip is strongly hooked and acute, but is destitute of the strong tooth characteristic of the true falcons; and the lateral margins are more or less festooned. The wings are long and usually pointed, with the third, fourth, and fifth quills longest; and the tail is long, broad, and rounded. The tarsi are rather long, but vary greatly in their clothing, being sometimes covered with scales of various forms, and sometimes completely clothed with feathers. The toes are long and powerful, the inner one being usually stronger than the outer: they are all armed with long, strong, and greatly acute claws. The finest of the species is the well-known golden eagle (*Aquila chrysaëtos*). It is a solitary bird, building its nest on ledges of rock in the wildest part of the country, and far from the habitations of man. It is very common throughout Western Continental Europe, and less common in Scotland, India, North Africa, and North America. The general colour of the plumage is deep brown, mixed with tawny on the head and neck, the feathers on the back being finely shaded with a darker hue. The wings, when closed, reach to the end of the tail; the quill-feathers are chocolate-coloured, with white shafts; the tail brown; feet yellow. It measures in length about three feet, with an expansion of wing of a least seven feet, and weighs about fourteen pounds. The female is rather larger than the male. Its strength is prodigious. It has been seen to carry up to its lofty nest lambs of several weeks old, and even young fawns. The ring-tailed eagle is the one and two-year-old young of the golden eagle. Besides the golden eagle, there is another British species of this family, which feeds on fish, and, for this reason, is always met in the neighbourhood of water. This is the white-tailed sea-eagle (*Haliaëtus albicilla*). It is rather larger than the golden eagle, but exhibits a smaller extent of wing. Despite this bird's large size and strength, it rarely ventures to attack any animal larger than a hare; indeed, it seems to prefer its prey ready killed, and subsists for the greater part on stranded fish and the carrion carcases of such animals as it may find. This bird builds upon ledges of rocks that overhang the sea: the nest is composed of sticks, seaweed, and similar coarse material. The American or white-headed sea-eagle (*Haliaëtus leucocephalus*) is found in every part of the United States of America, preferring the low lands near the sea-shore to mountainous districts. It is this bird that America takes as its symbol. It is about the size of the golden eagle, but of a lighter colour, and the legs are only feathered a little way below the knees. The bill is large, acutely hooked, and of a bluish colour. A row of strong, bristly feathers hangs from its lower mandible, and from this it takes its occasional name of Bearded eagle. Its chief prey is fish. Besides those enumerated, there are the crowned eagle (*Aquila coronata*) found in Africa; the superb eagle (*Falco superbus*) of Guinea; the cheela eagle (*Falco Cheela*) of India; the royal eagle (*Aquila imperialis*) of Northern Africa and some parts of Southern Europe; the spotted eagle (*A. nævia*); the vulturine eagle (*Aquila vulturina*) of Caffraria; and the Australian eagle (*A. fucosus*).

EAGLE-HAWK (*Morphnus*, or *Spizaëtus*), a genus of *Falconidæ* of the Eagle group, but consisting of species of a comparatively small size, and characterized by short wings, long slender legs (tarsi), and comparatively feeble toes and claws. They are natives of warm climates, chiefly of South America, but also of Africa and the East Indies. Some of the species are very beautiful in form and colour.

EAGLE-OWL (*Bubo maximus*), a genus of the Owl family, found in almost all parts of America. (*See* OWL.)

EAGLE-STONE, a variety of argillaceous iron ore, having a concentric structure and occasionally so decomposed as to contain a loose kernel that rattles when shaken. The ancients imagined that this stone was the egg of the eagle, the internal nodule being the embryo eaglet. (*See* also GEODE).

EAR, *eer* (Ang.-Sax.), the organ of hearing, consisting of three parts—the external ear, the middle ear or tympanum, and the internal ear, or labyrinth. The external ear consists of an expanded trumpet-shaped cartilaginous structure, called the pinna or auricle, which collects the sounds, and a tube which conveys these sounds to the internal ear. The pinna or auricle is of an oval form, with the margin folded and the larger end placed upwards. The round rim-like margin is called the helix, and the depression immediately within the groove or fossa of the helix. Within the latter is a large elevation, called the antihelix, which presents at the upper part a well-marked depression—the fossa of the antihelix. In the centre of the pinna is a deep hollow, named the concha, which conducts to the opening of the meatus auditorius. In front of that hollow is a projection of a triangular shape, called the tragus; and on the opposite side of the hollow, rather below the level of the tragus, is another projection—the antitragus. Inferiorly the pinna is terminated by a soft pendulous part, called the lobule. The auditory canal, *meatus auditorius externus*, or the tube by which sound is conveyed from the pinna to the internal ear or tympanum, is about an inch and a quarter in length, and is formed partly by bone and partly by cartilage and membrane. Around the entrance of the meatus are some fine hairs; and there are also ceruminous glands, which secrete the ear-wax, and open on the surface by separate orifices. The middle ear or tympanum is an irregular cavity situated within the petrous bone, and interposed between the meatus auditorius and the labyrinth or inner ear. It is filled with air and communicates with the pharynx by the Eustachian tube. It is traversed by a chain of small movable bones, which connect the membrana tympani with the labyrinth, and serve to convey the vibrations communicated to the *membrana tympani* across the cavity of the tympanum to the internal ear. The outer boundary of the cavity is formed by the membrana tympani, and by a small portion of the surrounding bone. This membrane is a thin semi-transparent substance, nearly oval in form, separating the cavity of the tympanum from the bottom of the auditory canal. It is directed very obliquely towards the auditory canal, its external surface being concave, its internal convex. The inner and fundamental portion of the organ of hearing is called, from its complexity, the labyrinth, and consists of three parts—the vestibule, the semi-circular canals, and the cochlea. It consists of a series of cavities channelled out of the substance of the petrous bone, communicating externally with the cavity of the tympanum and internally with the meatus auditorius internus, which contains the auditory nerve. Within the osseous labyrinth is contained the membranous labyrinth, upon which the ramifications of the auditory nerve are distributed. The sense of hearing is, strictly speaking, only a refinement of the sense of touch. The impressions with which it is conversant arise wholly from peculiar undulations of the particles of ordinary matter, propagated in obedience to its ordinary laws through the medium in which the animal lives, and impinging more or less immediately upon a sensitive part. The trumpet-like pinna or auricle of the external ear serves to collect the sound, which is then conveyed, by means of the meatus auditorius externus, to the membrana tympani. This is thrown into vibration, which is communicated to the malleus, and is carried by the incus and stapes to the membrane of the fenestra ovalis. From this last the motion is communicated to the various parts of the membranous labyrinth, taken up by the fine filaments of the auditory nerve, and conveyed to the brain.

EAR-SHELL (*Halistis*), a genus of univalve mollusca, the shell of which somewhat resembles in shape the human ear. The head of the animal is large, having two long round tentacula, with eyes at the base or footstalks. Foot very large, having the margin fringed all round. It is always found near the surface of the water; and is plentiful in the East Indies.

EARTH, *erth* (Sax., *eorth*; Ger., *erde*), the name given to the globe on which we live, which constitutes one of the larger, or primary, planets of our solar system, revolving round the sun as a centre. The Earth is the fourth planet from the Sun in order of distance (*see* PLANETS), including the planet Vulcan, discovered in 1859 between the Sun and Mercury. Its mean distance from the Sun is nearly 93,000,000 miles, and it performs an annual revolution round that body in 365 days, 6 hours, 9 minutes, 6·9 seconds. The form of the earth, speaking in general terms, is globular, or spherical: and the simplest proof that can be adduced in support of this fact is that the extent of land or water over which we can look is much greater when we are on the top of a mountain or lofty tower, or at the mast-head of a vessel, than when we are on deck, or on the ordinary level of the ground; and that the tops of the masts of a vessel at sea always come into sight before the hull, which would not be the case if the hull of the distant vessel were not hidden from us by the convexity of the surface of the water. The same effect is also visible when we approach a city on land: the tops of the towers and the spires of the churches are seen before buildings of less altitude rise into sight. The earth moves in an elliptical orbit from east to west, and moves through space at the rate of 19 miles in a second, and travels over a distance of 1,641,600 miles per day, or nearly 600,000,000 of miles in the course of the year. It revolves on its axis in 23 hours, 56 minutes, 4 seconds. That period of time forming a day, as the time of revolution around the sun makes a year. The velocity of the rotation about its axis varies from 0 at the poles to about 1,000 miles an hour at the equator. The Earth's axis has an inclination of 23½ degrees to the plane of its orbit: from this arises the phenomena of the seasons, and the variation in the length of dayand night at various periods of the year. (*See* CLIMATE, DAY, NIGHT, SEASONS, &c.)

Shape of the Earth.—The form is nearly spherical, but not exactly so, being slightly flattened at the poles, or points marking the extremities of its axis of rotation. The reason of the variation from the true spherical form is that the velocity of the earth's daily rotation upon its axis being greatest at the equator, the consequent greater action there of the centrifugal force (*see* CENTRIFUGAL FORCE) would produce a bulging out in the equatorial region and a flattening at the poles. The influence of this force in determining the shape of the earth is probably now very slight, but was considerable in the early history of our planet, when it was in a semi-fluid condition.

Size.—The mean equatorial diameter is 7,925 English miles. The polar diameter is 7,898 miles. The mean circumference, 24,869 miles. The area of surface, 196,000,000 square miles. The solid contents, 259,373,000,000 cubic miles.

Weight.—The density or weight of the earth has been ascertained with great precision by the result of many remarkable experiments, conducted over a long series of years by eminent observers from Newton to Baily and Professor Airey. The principle on which these experiments have been conducted is, to ascertain the force of attraction by certain bodies of known dimensions, and then, the size of the earth and its attractive force being known, to work out the problem in this manner:—As the size of the earth is to that of the object tested, so would be its attractive power if the specific densities were the same, attraction being in proportion to density. If the proportion of attraction is not the same, the earth and the other body must be of different densities, and it then remains to be ascertained what specific density of the earth, its size being known, would give the attractive power it is known to possess. Newton made a very near approximation to the true result by abstract reasoning; and between 1774 and 1776 Dr. Maskelyne, the Astronomer Royal, endeavoured to ascertain the attraction exercised by a large mountain in deflecting a plummet from the vertical line. The mountain of Schehallion in Perthshire was selected, but the results of the experiments were not scientifically satisfactory. Henry Cavendish, one of the greatest of English natural philosophers, "the Newton of chemistry," suggested another mode of investigation, which was carried out by Mr. Francis Baily in a series of experiments extending over several years, resulting in ascertaining the exact weight or density of the earth. In these experiments the attraction exercised by large balls of lead on small balls of lighter material was observed and calculated; and then, in accordance with the rule given above, the attractive force of the earth and a mass of lead of the same size was contrasted, and the relative densities of the earth and lead ascertained. The result of these carefully conducted calculations is that the weight is 5,842,000,000,000,000 (5,842 trillions) of tons, or more than 5½ times that of water.

Temperature.—The temperature of the earth varies at the earth's surface at different times from different causes. (*See* DEW, METEOROLOGY, TEMPERATURE.) As we descend below the surface, as in the shaft of a coal-mine, for example, the heat is found to increase to the extent of 1° Fahrenheit for every 15 or 20 yards; but it is not at all certain that this would be found to be a fixed law, and that the heat would increase in this ratio as we approached the centre of the earth, if it were possible to do so.

EARTHQUAKE, *erth'-kwaik* (Sax., *cwacian*, to tremble), a term applied to any shaking or tremor of the outer surface or solid crust of the globe. It is asserted with confidence that the surface of the earth is at no time free from these tremblings, frequently so slight as to be scarcely noticeable, at other times so extensive and terrific as to produce the most appalling catastrophes. Records of more than 7,000 earthquakes, so disastrous as to induce special remembrance, which have occurred between the remotest period known to history and the present time, have been preserved. That earthquake phenomena are connected with volcanic action can scarcely be doubted. The result of observations carefully made and extending over a long period of time show that great volcanic eruptions are almost invariably accompanied by shocks of earthquake; but it is also an ascertained fact that some of the most terrible earthquakes recorded in history have not occurred in volcanic regions. The movements of the ground during an earthquake are vibrations either tremulous, vertical, horizontal, or rotatory. Sometimes these vibrations follow each other rapidly; sometimes they occur singly; and in other cases they appear to take place simultaneously. No previous intimation is given of the approach of the shock—which is thus made more terrible from its suddenness. In Chili and adjacent parts of South America, slight tremblings of the surface of the earth are of almost daily occurrence, and attract very little attention. The vertical movement is similar to that produced by the explosion of a mine—the surface being broken up, and human beings and animals, rocky masses and other matters on the surface being shot perpendicularly into the air. Great earthquakes are marked by horizontal movements, propagated in undulations, like waves upon water, and estimated to travel at the rate of nearly thirty miles in a minute. Rotatory movements have been observed, but are unfrequent. When they take place walls are twisted round without being prostrated, and parallel rows of trees and ridges in fields are deflected. The direction of the shocks is either linear or in circles and ellipses, gradually decreasing in intensity with the distance from the central or focal points. The shocks are accompanied by great noises, in some cases like the rumbling of distant thunder, in others loud detonations like the discharge of cannon; the most remarkable sounds being described as resembling the clanking of chains, as if huge masses of mineral or vitrified matter were struck in caverns underground. Regarding these sounds, a suggestion has been made:—"Sometimes at stations very remote, where no shock whatever has been perceived, the sounds of explosion have been heard the same instant as at the sites of catastrophe. As sound requires a definite time to be transmitted through the air, it could not in these cases have been propagated by that medium. Solid bodies are much better conductors of sound, baked clay transmitting it with ten or twelve times the velocity of the open air; yet the supposition of the sonorous waves being conducted by the surface of the earth is untenable, because time is still demanded for the transport. It is likely, in such instances, that the sounds originated at such an immense depth below the surface as to be nearly equidistant from all the places where they were observed." Careful observations, however, made after the great Neapolitan earthquake of 1857, pointed to the conclusion that the "seismic centre" (Gr., *seismos*, earthquake), or focal depth of the convulsion, was only about six miles below the surface; and similar calculations respecting an earthquake in India in 1857 gave a depth of about thirty miles, which there is reason to suppose is the maximum. The prodigious force exerted in these subterranean convulsions may be partially appreciated by a reference to some of the more remarkable results which have been observed. The shock of the earthquake which produced such terrible results at Lisbon in 1755 was felt with more or less intensity over an area of 7,500,000 square miles; it extended to Finland, in the north of Europe, and some of the West India islands, and produced agitation of the waves of Lake Ontario, in North America. The velocity with which the shock travelled was computed to have been about twenty miles a minute, or 1,760 feet a second, or nearly half as fast again as the average velocity of sound; and the sea rose into a wave sixty feet high, which broke upon the shore. An earthquake at Guadaloupe, in 1842, was felt from the mouths of the Amazon, in South America, to the coast of South Carolina, North America, a distance of 3,000 miles, and over a breadth of 70 miles. In 1692 Port Royal, Jamaica, was destroyed, and "houses engulfed forty fathoms deep." In 1693 an earthquake in Sicily destroyed 54 towns and 300 villages, more than 100,000 lives being lost. In 1797 the whole country between Santa Fé and Panama, Central America, suffered from an appalling convulsion: "40,000 people were buried in one second." In September, 1759, on the lofty table-land about 150 miles south-west of the city of Mexico, an area of four square miles was suddenly raised about 550 feet, and numerous cones appeared, one of which, the volcano of Jorullo, is nearly 1,700 feet high. A contrary effect was produced in Java in 1772, when a lofty mountain entirely disappeared, the area sunk being fifteen miles long and six miles broad. A great earthquake in Chili in 1822 produced a permanent elevation of from two to seven feet of quite 100,000 square miles of land between the Andes and the coast; and distinct traces of lines of sea-beaches at higher levels farther inland indicate previous liftings-up of the same region at different times along the same lines. These are but a few instances of the stupendous force exerted, out of many hundreds which might be quoted; and it is estimated that at least 13,000,000 human beings have perished from earthquakes. The cause of the peculiar agitations of the surface of the earth presents a problem which is not easily solved, although various theories have been propounded. The "Steam explosion" theory has been ingeniously advocated. Mr. Mallet, noticing the fact we referred to, that volcanic eruptions are commonly followed by shocks of earthquake, and assuming that the lines or centres of volcanic action are generally near the sea, supposes that fissures may be formed in the bed of the ocean by submarine eruptions, that water flows in, reaching the central fire, and that, arriving there, it assumes the spheroidal form, until the surface with which it is in contact is cooled, when an explosion takes place, an earthquake being the result. A more satisfactory explanation has been given by the late Professor H. D. Rogers and his brothers, who gave great attention to the subject; they express a very strong opinion that a great "pulsation" of the molten fluid mass in the centre of the earth takes place, and is carried forward in the shape of huge waves, bearing along, or floating, as it were, the rocky crust of the earth above. The structure of certain mountain ranges remarkably confirms this theory.

EARTHS (in Chemistry).—The old chemists regarded as elementary, a class of substances which are insoluble in water. These "earths" are now known to be compound, consisting of a metal in combination with oxygen which do not decompose water. Many of them have been but imperfectly examined, owing to their extreme rarity. Alumina, a constituent of all clays, and glucina, found in the emerald, are the most important. (*See* ALKALINE EARTHS.)

EARTH-WORM (Ang.-Sax.) (*Limbricus*), a genus of *annelida*. Its outward appearance is a body composed of numerous narrow rings (sometimes more than a hundred in number) closely approximated to each other; the colour of the body is reddish, or purplish; of a cylindrical form, somewhat pointed at the anterior extremity, and usually a little flattened at the tail. It is without the organs of sight. The organs of motion consist of a double row of bristles running down the lower surface of the body, and which are capable of being withdrawn within small hollows when not in use. The mouth is unarmed, and the intestine runs straight through the body. The vascular system consists of two longitudinal vessels running along the ventral and dorsal regions of the body, and united by numerous branches. The blood is red. Like the leeches, this worm is furnished with ciliated canals, which have been supposed to serve as organs of respiration; but their real destination appears to be still uncertain. As far as relates to its appearance above the ground, the earth worm may be regarded as a nocturnal animal. In the night and at early morning, hundreds may be seen in localities where, during the daytime, not one is to be seen. They are of immense utility in improving the soil. The organs of the earth-worm's locomotion prevent its moving backwards, whilst the expansion of the rings, as it contracts the anterior segments and draws forward the hinder parts, widens a passage for it through the earth, whose particles were close together before. They are thus, in their multitudes, of incalculable utility in constantly loosening and stirring the soil, and accumulating on the surface those little hillocks of earth known as "worm-casts." On this subject the late Mr. Darwin, who gave it long and careful attention, remarks: "The burrowing of earth-worms is a process exceedingly useful to the gardener and agriculturist; and these animals are far more beneficial to man in this way than they are injurious by devouring the vegetables set in the soil. They give a kind of under-tillage to the land, performing the same below ground that the spade does above the garden, and the plough for arable land; and loosening the earth so as to render it permeable to air and water. It has been shown, too, that they will even add to the depth of soil; covering barren tracts with a layer of productive mould. Thus, in fields which have been overspread with lime, burnt marl, or cinders, these substances are in time covered with finely divided soil well adapted to the support of vegetation. That this result, which is commonly attributed by the farmers to the 'working down' of the materials in question, is really due to the action of the earth-worms, appears from the fact that in the soil thus formed large numbers of worm-casts may be distinguished. These are produced by the digestive process of the worms, which take into their intestinal canal a large quantity of the soil, through which they burrow, extract from it the greater part of the vegetable matter it may contain, and eject the rest in a finely divided condition. In this manner a field manured with marl has been covered in the course of eighty years with a bed of earth averaging thirteen inches in thickness." In his last published work "Vegetable Mould and Earthworms," Mr. Darwin says: "Coins, gold ornaments, stone implements, &c., if dropped on the surface of the ground, will infallibly be buried by the castings of worms in a few years, and will thus be safely preserved until the land is at some future time turned up." The same eminent naturalist was led to the conclusion that "all the vegetable mould over the whole country has passed many times through, and will again pass many times through, the intestinal canals of worms." Besides their usefulness in the manner above described, the earth-worms are of importance as food for birds, fish, &c. Their value as bait for fishes is well known to every angler. The power of reproducing parts after mutilation is very great in this animal, as in the whole of the order. It is generally supposed that the earth-worm may be propagated by division; but this scarcely appears to be the case. It is said, however, that if it be divided across the middle, the part bearing the head will develop a new tail, although the tail will soon die; and that if the head be cut off, the body will form a new head; but it appears that both portions never survive the mutilation.

EARWIG, *eer'-wig* (Sax., *ear* and *wicga*, a worm or grub), a genus of orthopterous insects, forming the family *Forficulidæ*, but by some naturalists considered to be a distinct order, *Dermaptera*, "leather-winged." One of the most striking characters of the earwig is the structure of the hinder wings. The radiating nervures, instead of finding their common centre at the base of the wing, as is the case in most *Orthoptera*, spring from the extremity of a broad leathery piece, which occupies about a third of the anterior margin. Other radiating nervures occupy the space between the principal nervures, but only run from the posterior margin to the middle of the wing; and the whole are united by a transverse nerve, which runs parallel to the posterior margin. By the assistance of these nervures, the wing, which is of very delicate texture, folds up exactly the shape of a closed fan; but as the wing-cases of the earwig are very short, the wings can only be got under them by very complicated transverse folding in two places—namely, at the apex of the leathery basal piece and at a second point about the middle of the wing, where the nervures appear to be thickened. Earwigs are distinguished from some other orthopterous insects by having the posterior legs formed for running. The female has no corneous ovipositor; and a remarkable fact connected with the insect is, that she sits upon her eggs in the manner of the hen, and the young, as soon as hatched, creep under the belly of the mother for protection at the approach of danger. In both sexes the abdomen is furnished with a pair of forceps, apparently of use as an instrument of defence. The antennæ are slender, filiform, and inserted before the eyes, and vary considerably as to the number of their joints. The thorax is generally of a rounded form, and but slightly convex. Ridiculous as is the fancy, there is no doubt that the insect's name, earwig, is furnished by the delusion that it will creep into the ears of sleeping persons. In all European countries the insect's appellation is significant of the belief. Newman, however, in his Introduction to the "History of Insects," says, "The shape of these wings (the hind ones), when fully opened, is nearly that of the human ear; and from this circumstance it seems highly probable that the original name of this insect was ear-*wing*." Earwigs appear to prefer damp situations, and are found under stones and under the bark of trees in great abundance. They subsist chiefly on the leaves and flowers of plants, and on fruits.

EBENACEÆ, *eb-en-ai'-se-e* (Lat., *ebenus*; Sp., *ebano*, ebony), the Ebony family, a natural order of dicotyledonous plants, in the sub-class *Corolliflorœ*, consisting of about 160 species, mostly natives of tropical India. Many of the *Ebenaceœ* are remarkable for the hardness of their timber, which is known under the names of ebony and iron-wood. Many species have edible fruits, and some have astringent barks. (*See* DIOSPYROS.)

EBONY. (*See* DIOSPYROS, EBENACEÆ.)

EBULLITION, *eb-ul-lish'-un* (Lat., *ebullitio*, a bubbling up), the bubbling agitation of liquids after they have been heated to their boiling-points. On gradually heating water in a glass flask by means of a spirit-lamp, we first observe the formation of minute air-bubbles, which dart through the liquid with great rapidity. As the temperature increases, these give place to larger bubbles, consisting of steam, which are formed at the bottom of the vessel, and which rise a little way in the liquid and then contract and disappear, producing a hissing or simmering sound. But as the heating goes on, these steam-bubbles rise higher and higher in the liquid, until at last they reach the surface and escape, when the liquid is said to be in a state of ebullition. The temperature at which the ebullition of a liquid takes place varies with the pressure of the atmosphere. When the barometer stands at 30 inches, water begins to bubble at the temperature of 212° Fah., because at this temperature the elastic force of steam will support thirty inches of mercury, and consequently the bubbles acquire the power of breaking through the surface of the heated liquid.

ECBALIUM, *ek-bai'-le-um* (Gr., *ekballo*, I cast out, expel), a genus of plants belonging to the natural order *Cucurbitaceæ*. The species *E. officinarum* is commonly called the squirting cucumber, from the fruit separating, when ripe, from its stalk, and expelling its seeds and juice with much violence. It is a native of the south of Europe, and is cultivated in England. The feculence deposited from the juice of the fruit, when dried, constitutes the drug called elaterium, or extract of elaterium, which is a powerful hydrogogue cathartic. It owes its properties to a bitter principle, named *elaterin*.

ECCENTRIC CIRCLE.—According to the Ptolemaic system of astronomy, every heavenly body was supposed to move round the earth, as the centre of the universe, in a circular orbit, and at a uniform rate of speed. When it was found, however, that the apparent orbits of the heavenly bodies were not circular, and that they moved through unequal spaces in equal times, they accounted for it by supposing that the earth was situated in a position which did not coincide with the centre of the orbits of the bodies that were revolving round it, and in this manner they attempted to reconcile the discrepancy between the apparent motion of the sun and planets and the theory they had invented with regard to them. The orbit of a revolution of a heavenly body is therefore called an eccentric circle in the Ptolemaic system, because the earth, round which it revolves, must be considered to occupy a position that is out of, or removed from, its centre.

ECCHYMOSIS, *ek-ke-mo'-sis* (Gr., *ek*, out of; *chumos*, juice), a discoloration of the skin, occasioned by the rupture of blood-vessels and extravasation of blood, usually produced by falls, blows, sprains, and the like. The presence of ecchymosis is generally considered as evidence that blows were given during life, or almost immediately after death. One of the most common examples of ecchymosis is a black eye. In general, the discoloration does not take place till some time after the receipt of the injury; and it may usually be much diminished by the speedy and continued application of cold wet cloths to the part.

ECHIDNA, OR PORCUPINE ANT-EATER, *e-kid'-na* (Gr.), a genus of quadrupeds found only in Australasia. There are two species —*Echidna hystrix*, peculiar to New South Wales, and *Echidna setosa*, chiefly found in Van Diemen's Land. They are of the same size, and, in general appearance, resemble the common hedgehog. They affect hilly countries, living in burrows, and feeding on insects, principally ants and termites, which they capture by the protrusion of their long viscous tongues; which latter organ, as in the case of the true ant-eaters, by an arrangement of longitudinal and annular muscles, is capable of being extended and contracted to a considerable extent. The head is small; muzzle elongated, and terminating in a little mouth, destitute of teeth, but furnished with several rows of small spines on the palate, directed backwards. The legs are short and strong, and the feet all furnished with five toes, armed with powerful claws. With the aid of these latter, it can burrow with great rapidity, and when pursued, and not allowed sufficient time to bore a complete hiding in the earth, it enters itself so far as to expose only its prickly back to the threatened assault.

ECHIMYD, a genus of rodent quadrupeds, resembling dormice, but having scaly tails and coarse fur mingled with flattened spines. They are all South American.

ECHINOCACTUS, *e-ki-no-kak'-tus* (Gr., *echinos*, hedgehog; *cactus*, a spiny plant), a genus of plants belonging to the natural order *Cactaceæ*. The stem is nearly globular, and is furrowed with longitudinal grooves, varying in number and depth. The flowers appear on the salient angles of the stem, in the centre of little tufts of bristles and spines. Many species of this genus are in cultivation as stove or greenhouse plants.

ECHINODERMATA, *e-ki-no-der'-ma-ta* (Gr., *echinos*, spine, and *derma*, skin), a class of radiate animals, the highest in organization of that great division. They are characterized by possessing a well-organized skin, under which, or attached to it, are frequently found plates of solid matter constituting a kind of skeleton. They have a digestive and a vascular system, and a circular nervous system has been detected in many of the species. A muscular system is constantly present. The nutritive apparatus of the *Echinodermata* is very simple, presenting in most of the family a single orifice, destitute of teeth, in the centre of the lower surface of the body, performing the functions both of the mouth and anus; but in some presenting a digestive cavity, with an orifice for the evacuation of its contents, distinct from that by which the food is taken in. The muscular motion is generally present in these animals, but the organs of motion in them are various, the principal ones being the membranous tubes, which can be protruded at will through the ambulacral apertures, and which have been termed the feet. Whether or no the highest among the *Echinodermata* possess sight is not a settled matter. They are all marine animals, and are fairly represented by the star-fish, sea-urchin, and sea-cucumber.

ECHO, *ek'-o* (Gr., *echo*, sound), a popular term applied to reflected sound. When sound from any origin is propagated through the elastic medium of the atmosphere, undulations, or waves, are produced in the air. When these waves come in contact with a cliff, or wall, or other opposing surface, they are reflected like light or heat. When the sound is so reflected as to come back to the observer's ear, it is called an echo. In order that the echo may be heard at the place where the sound originated, it is necessary that the reflecting surface should be at right angles to a line drawn to the point where the observer stands. An oblique wall throws off the echo so that it can be heard by others, but not by the originator of the sound. The most perfect echoes come from surfaces that are either even or so curved as to be in the form of a concave mirror. This, however, is not necessary; for a very distinct echo is often returned from the edge of a wood. Sound travels at the rate of 1,125 feet in a second; consequently it is necessary, in order to obtain an echo, to be at least sixty-two feet from the reflecting surface, and about the tenth of a second must be allowed to elapse in order to distinguish the sound from the echo. When nearer than this distance, the echo blends with the original sound, thus making both indistinct. In many churches and public halls, where the principles of acoustics have not been considered, the multitudinous echoes drown the speaker's voice. The distribution of sound in public buildings, so that the echoes may assist in strengthening the original sound, is a subject of great importance. When several objects reflect sound, the number of echoes is multiplied, the sounds growing weaker and weaker till they die away. The number of syllables that an echo will repeat depends upon how many can be uttered in the time that the sound takes to go and return from the reflecting surface.

ECLIPSE, *e-klips'* (Gr., *ekleipsis*), the entire or partial obscuration of a heavenly body; which may be caused in two ways—either by another body passing between it and the sun from which it derives its light, as in the case of an eclipse of the moon, when the earth passes between the sun and moon; or by the passage of a body between that which is eclipsed and the earth, as in an eclipse of the sun, when the moon passes between the sun and the earth. The eclipses which happen most commonly from the first-named cause are those of the moon (*see* LUNAR ECLIPSE), the partial eclipse of Jupiter by the passage of one of its satellites between it and the sun, and the eclipses of the satellites of that planet (*see* JUPITER); while those which are occasioned by the second cause are eclipses of the sun by the moon passing between it and the earth (*see* SOLAR ECLIPSE), or by Venus and Mercury crossing the sun's disc, or the occultation of a fixed star by the moon. (*See* MERCURY, MOON, VENUS.) Eclipses of Jupiter and his satellites can also happen through the second cause as well as through the first. Eclipses of the sun and moon, like the appearance of comets, were generally regarded by the ancients as omens of some terrible public calamity that was about to happen. Within the last few years astronomical expeditions have been arrayed to observe eclipses of the sun from various points of the earth's surface; and by the aid of photography very important records of appearances have been obtained. The theory of eclipses and the various phenomena that attend them are given in the articles to which reference has been made above, and all technical terms used in the description of an eclipse will be found under their proper headings. (*See* EMERSION, IMMERSION, PENUMBRA.)

ECLIPTIC, *e-klip'-tik*, the great circle in which the sun appears to move; so called because the moon is always found to be in or near this circle at the time of an eclipse. The plane of the ecliptic has a mean inclination of 23° 30′ to that of the equator. The angle of inclination varies to the extent of 5″ or 6″ in ten years. It is computed that the obliquity of the ecliptic varies between two extreme limits; namely, from 23° 53′ to 22° 54′, and that it takes about 8,500 years to effect the transition from one limit to another. The change in the angle of inclination arises from the attraction that Jupiter, Mars, and the other planets exercise on the earth. The inclination of the ecliptic to the equator is said to have been first measured by Eratosthenes about 250 B.C. The ecliptic is divided into four quadrants or arcs of 90° each by the equinoctial points and solstices. (*See* EQUINOXES, SOLSTICES.) These quadrants are subdivided into three arcs of 30° each, which are called the signs of the zodiac (*see* SIGNS OF THE ZODIAC), and named from the constellations which happened to be found in each when the division of the ecliptic was first made. These do not now coincide, although the names are still preserved. Astronomical calculations are made from that point of intersection of the equator and the ecliptic, which is the position of the sun in the heavens on March 21st, and which is known as the first point of Aries. (*See* ARIES.)

ECSTASY, *eks'-ta-se* (Gr., *ekstasis*, a standing out, change, or transposition), is a condition of mind in which the soul seems as if it were transported out of the body. The varieties of ecstasy are infinite, but they are all marked by an altered or diminished consciousness. The individual may be either completely passive or violently moved, and may or may not have any knowledge of what is going on around him. Sometimes he assumes the air of inspiration. This mental condition may be induced by fixing the mind too exclusively on one idea or object, so as to overlook all other sensations, as in mesmerism and certain forms of disease. It is also known in connection with certain highly religious states of mind.

ECTOZOA, *ek-to-zo'-a* (Gr., *ektos*, without; *zoos*, living), a term applied to those parasitic animals, such as lice, ticks, &c., which live upon the external parts of other animals. The word is used in contradistinction to *entozoa*.

ECTROPION, *ek-tro'-pe-on* (Greek, *ek*, and *trepo*, I turn out), a condition of the eyelid, in consequence of which it turns away from, and does not cover the globe of the eye. It can generally be remedied by a slight surgical operation.

ECZEMA, *ek'-ze-ma* (Greek, "to boil out"), an eruption of small vesicles on the skin, with a little inflammation around the bases, but not attended by fever.

EDDY, *ed'-de* (Ang.-Sax.), a circular motion of the water, either in rivers or in the sea, but most frequently in the former, caused by the opposition of currents.

EDENTATA, *e-den-tai'-ta* (Lat., toothless), an order of mammalia characterized by the absence of incisive teeth in their jaws, and the length of their claws. With regard to the incisors, however, there is an exception to the rule in the case of the armadillo (*Dasypus setosus*), in which a single tooth is found in each intermaxillary bone, but placed so completely at the sides of these bones, that the front of the mouth is quite destitute of teeth. The number of existing edentata is not nearly so great nor are they so gigantic in size as at a remote period of the world's history, as the remains of the mylodon, megatherium, and the megalonyx testify.

EDIBLE BIRDS' NESTS. (*See* NESTS, EDIBLE.)

EEL, *eel* (Sax., *æl*), a family of fishes (*Anguilla*), belonging to the apodal section of the *Malacopterygii*. Their long and cylindrical bodies are covered by a thick and soft skin, in which the scales are so deeply imbedded as to be scarcely apparent. The gill orifices are very small, and are situated far back; so that there is a long passage from the gill-chamber outwards; and hence, the gills not soon becoming dry, these fishes can remain a long time out of the water, some of them, indeed, leaving it of their own accord. Most of the eels are included in the Linnæan genus *Murænа*, and are divided by some naturalists into the families *Synbranchidæ*, *Murænidæ*, *Anguillidæ*, *Congeridæ*, and *Ophisuridæ*. The

Synbranchidæ have the gill-passages so united under a common integument as to present externally only a single orifice: they are almost destitute of fins. The species are few, and they are chiefly found in tropical seas. The *Murænidæ* are also generally destitute of fins, or nearly so: they are all destitute of scales, and never found in fresh water. The *Anguillidæ* are fresh-water fishes, though some of them occasionally visit the sea. They have mdderately large pectoral fins, anal and dorsal fins extending to and encompassing the tip of the tail, and numerous longish scales embedded in groups in the skin, so as to resemble lattice-work. *Ophisuridæ*, or snake-eels, are distinguished by the tail ending in a conical pointless fin. At least three species of eels are found in this country—the Sharp-nosed, the Broad-nosed, and the Snig. The first-mentioned, which is common in streams and lakes, is distinguished, as its name implies, by its comparatively long and narrow muzzle. Its colours are dark olive-green on the upper surface of the head and body; under surface silvery white. The clearer the stream in which the eel lives, the more vivid are its colours. The broad-nosed eel is not uncommon, and is often found in the same waters with the sharp-nosed, from which, however, it is to be readily distinguished by the comparatively greater breadth of its head and the situation of its eyes, which are placed in advance of the angle of the mouth; the body, moreover, is thicker in proportion to its length, and the teeth more numerous and stronger; and the dorsal and anal fins, which are much deeper and thicker, commence fartherback. In some parts of England this sort is known as the grig-eel. The snig is in many respects intermediate between the broad-nosed and sharp-nosed species; its colour is closely like that of the sharp-nosed eel. The snig is considered superior to other kinds for the table; but the sharp-nosed eel attains the greatest size—sometimes five-and-twenty, and even thirty pounds weight. The eel migrates at the approach of winter to warm estuaries, generally brackish, and at times perfectly salt. Those, however, which live in ponds, and cannot emigrate, bore down into the mud, and there remain during the colder months of the year. They are sometimes dug out of the mud-banks of rivers and lakes in considerable quantities. Eels are taken in the winter by means of *eel-spears*, or forks with several prongs, which are plunged into the mud. They are captured in great quantities by the use of large jar-shaped baskets, with funnel-shaped entrances, and flexible withes coming from the mouth inwards to a point. The eels can enter easily enough, but if they try to return, they find the entrance closed against them. These baskets are placed in weirs across streams. Small baskets of a similar construction, known as *eel-pots*, are sunk in the streams. Night lines, with baited hooks, are stretched across the water. Eels are also caught with lines baited with worms, in which needles are enclosed.

Eels, in paste, vinegar, and vegetable substances in process of decay, are infusoria of the family *Vibrionidæ*. They appear like minute pieces of thread, and some wind themselvés into spirals when they move.

EEL, CONGER. (*See* CONGER EEL.)

EEL, ELECTRICAL. (*See* ELECTRICAL EEL.)

EFFERVESCENCE, *ef-fer-ves'-ens* (Lat., *effervesco*, I boil over), the escape of gas in minute bubbles from a liquid. Thus, when any strong ammonia is uncorked, effervescence takes place, from the relief of pressure. It also happens when a gas is replaced in a solution by some liquid or solid, as where sulphuric acid is added to a solution of carbonate of soda to unite with the alkali, setting free the carbonic acid.

EFFLORESCENCE, *ef-flo-res'-ens* (Lat., *effloresco*, I blossom), the formation of an opaque powder upon the surface of a crystal, from its losing its water of crystallization spontaneously, the action generally continuing until the whole has fallen to powder. Familiar instances take place in common carbonate of soda, and sulphate of soda, or Glauber's salt. It is the reverse of deliquescence.

EFT (Ang.-Sax.), a common name for lizards and newts, but more strictly limited to the latter. (*See* NEWTS.)

EGG, *eg* (Sax., *æg;* Lat., *ovum*), a body produced in the females of birds and certain other animals, containing an embryo or fœtus of the same species, or the substance from which a similar animal is ultimately produced. Those animals in which reproduction takes place by means of eggs are called oviparous. The marsupial quadrupeds and the mono-tremata form the connecting link between the warm-blooded animals which are oviparous and the truly viviparous animals, which only belong to the mammalia. The number of eggs produced varies greatly in different animals; some birds only produce one egg in a year, while others produce as many as twenty. The roe of some fishes contains myriads of eggs. The eggs deposited by some animals are enveloped in a gelatinous substance; others are connected in various ways, sometimes being in the form of a string. The eggs of a large number of birds are used as articles of food, those most generally used belonging to the class of birds called poultry. The common domestic fowl, the turkey, and the pea-hen, are birds whose eggs are most generally used all over the world. In some of the islands of Scotland, the eggs of several species of sea-birds, such as the gull and guillemot, form an important article of food among the inhabitants. Although the eggs of birds are principally eaten, the eggs of the turtle are also considered a luxury; and the eggs of fresh-water tortoises are valuable for the oil which they yield. An ordinary hen's egg has an average weight of 875 grains, of which the shell and its inner membranous coating weigh 93·7 grains; the albumen, or white, 529·8 grains; and the yolk 251·8 grains. The shell contains about two per cent. of animal matter, and one per cent. of the phosphates of lime and magnesia, the rest consisting of carbonate of lime, with a trace of carbonate of magnesia. (*See* ALBUMEN.)

EGG-APPLES. (*See* SOLANUM.)

EGG-BIRD (*Hydrochelidon fuliginosum*, or *Sterna fuliginosa*), a bird of the Gull family, sometimes called the sooty tern, somewhat larger than the other members of the tern family. It abounds in the West-Indian seas, and is chiefly valuable for its eggs, which are about two inches long, cream-colour, sparingly streaked with purple. So highly are these eggs esteemed, that their gathering is a considerable trade. The nest of the egg-bird is made in the sand, and the eggs number from one to three.

EGGAR MOTH, *eg'-gar*, a moth of the

genus *Lasiocampa*, applied to the silkworm moth. The caterpillar of one species (*L. trifolii*) is as thick as a large quill, hairy, and of a yellowish-brown colour. It is common in clover fields.

EGLANTINE, *eg'-lan-tine*. A name given to the sweetbriar, and to other small-flowered species of roses.

EGRET, *e'-gret*, a name often applied to various species of heron, but not to the common heron; most frequently to those which have soft and flowing plumage, generally white. The French form of the name is commonly given to a tuft of feathers. (*See* AIGRETTE.)

EGYPTIAN BEAN. (*See* NELUMBIUM.)

EGYPTIAN VULTURE, one of the smaller *Vulturidæ*, of a genus (*Neophron percnopterus*) differing in some respects, especially in the bill, from a true vulture, and much smaller. The plumage of the male is white, except the great quill feathers, which are black. It is common in Egypt, where it is often known as Pharaoh's chicken.

EHRETIACEÆ, *er-e-ti-ai'-se-e* (in honour of D. G. Ehret, a German botanical draughtsman), *Ehretia* family, a natural order of dicotyledonous plants in the sub-class *Corolliflora* resembling the *Boraginaceæ* in most of their characters. There are 14 genera and 297 species, chiefly tropical trees or shrubs. Some species bear edible fruits. Some have a delicious odour, as *Heliotropium peruvianum*, the Peruvian heliotrope.

EIDER DUCK (*Somateria mollissima*), a species of wild duck inhabiting the frozen regions of the north. It is very abundant in Iceland, Lapland, on the shores of Baffin's Bay, &c., and is met with in the Scottish and the Fern Islands; especially on St. Cuthbert's rocks, from which it is sometimes named St. Cuthbert's Duck. Generally, it is of a size intermediate between the domestic duck and goose. The top of the head is soft velvety black, cleft behind by a narrow streak of white; the feathers from the nape of the neck to the throat are puffed out, and look as though the ends had been clipped. The cheeks, chin, upper part of the neck, the back, and lesser wing-coverts, are white; bastard wings and primary quills brown; the front part of the neck to the breast is dun-colour, and thence to the under part of the tail. The eggs are very fine, and the flesh not unpleasant in flavour. The King Eider, or King Duck (*S. spectabilis*) belongs to higher latitudes than the common eider, and is abundant on the coast of Greenland, Spitzbergen and Nova Zembla. It has been seen in Britain, but very rarely.

Eider Down.—This curious and beautiful down grows on the breast of the bird, and the mode adopted to procure it is somewhat singular. The nest is composed of seaweed, and any hole or ledge is evidently considered an eligible building site. The number of eggs laid is usually five, six, or seven; they are three inches long, two broad, and of a uniform pale green. When first deposited in the nest, they are allowed to go uncovered; but in a few days the mother begins to pluck the down from her breast, and to cover them over; and this process would seem to be indispensable to the growth and hatching of the young birds; for, if the nest be plundered, till the female has left no more down on her breast, the male bird will begin to furnish the comfortable covering from his own body. The common practice is to remove the whole of the eggs with the down, twice, and to leave the third lot of eggs, that the birds may not be thinned in number. The gross weight of the down yielded by one bird in a single season is half a pound; but this, when cleaned, is reduced by one half. The elasticity of eider down is so extreme that three-quarters of an ounce will fill a man's hat. It is capable of great compression, so that the down makes its appearance in balls no larger than a breakfast cup, but weighing about three pounds.

ELÆAGNACEÆ, *el-e-ag-nai'-se-e* (Greek, *elaia*, an olive, and *agnos*, chaste), the Oleaster family, a natural order of dicotyledonous plants in the sub-class *Monochlamydeæ*. There are four genera and thirty species, mostly natives of the northern hemisphere. The fruits of several species of the typical genus *Elæagnus* are eaten in Persia and some parts of India.

ELÆOCARPUS, *el-e-o-kar'-pus* (Gr., *elaia*, an olive, and *karpos*, a fruit), a genus of plants belonging to the natural order *Tiliaceæ*. The Molucca berries, which are frequently made into necklaces in India, are obtained from the species *E. serratus*.

ELÆOCOCCA, *el-e-o-kok'-ka*, a genus of *Euphorbiaceæ*, the seeds of which yield oils. In Japan the oil is used for food; but elsewhere in the East, for burning or in painting.

ELÆODENDRON, *el-e-o-den'-dron*, a genus of trees of the natural order *Celostraceæ*. One species (*E. glaucum*) is sometimes known as Ceylon tea; and the timber of another species (*E. croceum*), growing in South Africa, and much used in building and cabinet-making at the Cape of Good Hope, is known as saffron wood. The fruit of some species is eaten, and from others an oil, similar to olive oil, is extracted.

ELAIS, *el-a'-is* (Gr., *elaion*, oil), a genus of palms. The two species *E. guineenis* and *melanococca* are the Guinea oil-palms, from the fruits of which the vegetable butter called palm oil is extracted. The oil is of a rich orange-yellow colour, and is extensively used in this country in the manufacture of candles and soap. In Africa it is used as food by the natives. Being emollient, it is sometimes used in medicine as an embrocation to spasms and bruises. The hard stony putamen of the same fruits yield a limpid oil. Palm wine may be prepared from the juice which flows from the wounded spathes of the two palms.

ELAND, *e'-land*.—This animal, considerably the largest of all the antelopes, is known by several different names—the impoofoo, eland Cape elk, canna, or bastard eland, are among th many terms applied to it. The ordinary eland is a large heavy animal, weighing, at full growth, from 7 cwt. to 9 cwt; and, contrary to the rule amongst antelopes in general, is prone to be fat. Its usual size is that of a full-grown horse, measuring generally a little more than eight feet in length, and standing full five feet at the shoulder. The horns of the male are thick and heavy, and about a foot and a half in length. They are straight till they arrive at about three inches from the tips, where they bend outwards. They are also surrounded by a thick spiral wreath, which becomes indistinct at the points. The horns of the female eland are longer and smaller, and the spiral wreath is often absent. In both sexes the head is long and pointed, the ears large, the neck thick, and in front of the chest is a loose hanging skin or dewlap, with a border of long hair on its margin. A short erect mane of dark brown hair runs from the centre of the forehead to the root of the tail. This mane is directed backwards along the spine, but is reversed on the neck. The tail is more than two feet long, and terminates in a tuft of long black hair. The flesh of the eland is more prized as food than that of any other wild animal of Southern Africa. Elands were formerly very common in the neighbourhood of Cape Town; but they have been so universally hunted that they are only to be met with in the most retired parts of the colony. The disposition of the eland is very mild and gentle, and it seems predisposed to domesticity. It is gregarious, and lives in large herds upon the low hills and level plains. The scientific name of this animal is *Antilope oreas.*

ELANET, *el'-a-net*, a genus of *Falconidæ*, allied to the Kites. One species is common throughout Africa, and is found also in India. Another species is a native of the southern part of the North American continent, where it is known as the black-shouldered hawk. They feed on insects, small birds, and reptiles.

ELAPS, *e'-laps*, a genus of venomous serpents, of a slender form, and beautiful in colour. They are most common in the islands of the Indian archipelago, Australia, and tropical America.

ELASTICITY, *e-las-tis'-e-te* (from Fr., *élastique*, elastic; primarily from Gr., *elastes*, an impeller forward), that property which certain bodies possess of recovering their former figure or state after internal pressure, tension, or distortion. Elasticity is perfect when the body exactly recovers its primitive form after the force by which its form has been changed is removed. Perfect elasticity is, however, not to be found in nature. Aëriform fluids or gases approach nearer to perfect elasticity than any other substances. In solid bodies, as a general rule, elasticity is destroyed by use: thus a bow loses its elasticity by being kept bent. Iron and steel can have their elasticity increased by being tempered, that is, by contracting their volume suddenly after being expanded by heat.

ELATERIDÆ, *el'-at-e-ri'-de*, a family of coleopterous insects, divided into many genera. They are generally found upon the flowers and leaves of plants, which are their food. If they fall, or are placed on their backs, their legs are too short to permit them to regain their natural position in the ordinary way; but they can fling themselves into the air with a violent jerk, making a "clicking" noise. The names click-beetle and skipjack are, from that peculiarity, often given. Many of the species are British, and the fire-flies of tropical countries belong to this family.

ELATERIUM. (*See* ECBALIUM.)

ELATINACEÆ, *e-lat'-e-nai'-se-e* (Gr., *elate*, a fir; the leaves resembling those of the fir-tree), the Water-pepper family, a natural order of dicotyledonous plants in the sub-class *Thalamifloræ*, consisting of 6 genera and about 22 species—little annual marsh-plants. The plants of this small order are scattered all over the world. They are generally considered acrid.

ELBOW, *el'-bo* (Sax., *elneboga*), the joint of the arm formed by the lower end of the humerus and the upper end of the radius and ulna. (*See* ANATOMY.)

ELDER, *el'-der*, a genus of plants (*Sambucus*) of the natural order *Caprifoliaceæ*, consisting chiefly of shrubs and trees, very widely distributed throughout Europe, the north of Asia, and the north of Africa. The common elder (*S. nigra*) is found in all parts of Britain. It has rather large leaves, and cream-coloured flowers, which are followed by small black berries. Elder-flower water, employed in perfumery and confectionery, is distilled from the flowers, from which, also, boiled in lard, a cooling ointment is made. Elder-wine, made from the berries, is a favourite beverage, especially in winter time, when it is drunk hot, or "mulled." A less legitimate use of the berries is in the adulteration of port wine, and the manufacture of spurious port wine. The wood of the elder is of a yellow colour, hard, and susceptible of a fine polish, and is often used as a substitute for boxwood. There is a great amount of pith, employed, on account of its lightness, to make pith-balls for electric experiments. The scarlet-fruited elder (*S. racemosa*), a native of the south of Europe and of Siberia, is cultivated in this country as an ornamental tree—of great beauty. The juice of the berries is a powerful sudorific. The danewort, or dwarf elder (*S. Ebulus*), is a rather rare British plant, from the inner bark of which is made a decoction, sometimes administered with advantage as a remedy for dropsy.

ELECAMPANE, a genus of plants of the natural order *Compositæ*, nearly allied to asters. (*See* INULA.)

ELECTIVE AFFINITY, OR ELECTIVE ATTRACTION.—At one time chemists employed this phrase to describe the affinity or mutual attraction of certain bodies, and their tendency to combine. The phrase has recently been revived to express the connection between the chemical activity of a body and its combining weight.

ELECTRICITY, *e-lek-tris'-e-te* (Gr., *elektron*, amber), the most stupendous force in nature, apparently active throughout the universe, the cause of the phenomena described as attraction, gravitation, and magnetism, and most probably of heat and light. It is incessantly active, and maintains, it would seem, the physical life of the world. Science can only appreciate some of its results, and apply it on a very limited scale to practical purposes; but knowledge of its adaptability is growing every day, and what a few years since was little more than material for brilliant laboratory experiments, or the production of scientific toys, is now becoming a gigantic motive power available for the service of practical science and the progress of civilization. Already it provides a means of instantaneous communication between portions of the earth's surface most remote from each other; it is gradually superseding all other methods of artificial illumination; and it promises to make steam obsolete as a motive power. What other aid it may give, we know not, and we scarcely dare conjecture, although it would seem that the most vivid imagination must fail to apprehend its possibilities. It is in the earth beneath us, known as terrestrial magnetism; it is in the atmosphere around us, and its energy is seen in the lightning flashes which mark the discharge of force between clouds, each of which is a storage of force; and in the vast, indeed inconceivable, kosmos, electricity maintains the relations of suns and systems moving with enormous velocity and unvarying regularity through space.

It is a force which, so far as human intellect can appreciate it, knows no cessation or diminution or deterioration. It can be summoned but not created by any skill of man; made apparent in the results of friction or chemical action, but made apparent only, not produced. A spark the eighth of an inch long produced by contact with the small electric machine of the lecture-room is precisely similar in character to the terrible flash which splits a tree to fragments, striking it with sudden death, or topples down the most massive tower reared by the skill of man. In Oriental fables we read of lamps the rubbing of which produced an obedient geni ready to minister to every want. We can excite the electric force, and the most stupendous of all the genii of nature—if not, indeed, the one master-spirit, of which all known natural forces are but variations —is at our service; our servant, if we will, our most terrible master if we have not skill to conciliate him. Define the nature of the force, we cannot; to describe some of its aspects as exhibited in the results of experiments and of practical adaptation, we may more safely attempt. In an able paper in *The Nineteenth Century*, Viscount Bury says:—"Electricity being, like heat or light, a mode of motion, its manifestation is usually spoken of conventionally as a current. Probably there is no such thing; the force obeys certain laws, and acts in particular ways, but it does not flow bodily from place to place as a current does. It follows rather the analogy of light-undulations, or sound-waves. Sir William Thomson and others who have devoted themselves to the investigation of electrical phenomena avow themselves at fault; they do not know what electricity is; but, whatever it is, the earth contains a practically inexhaustible supply of it, and portions of it can be separated from the main body. The portion so separated has a tendency to escape and recombine. In doing so, it exerts energy; in other words, it performs work which may be directed, utilized, or measured." In common language, the force is described as the "electric fluid." That is a figurative expression conveniently used, but, as we have just seen, by no means scientifically precise. Throughout the 16th and the earlier part of the 17th centuries, philosophers had been experimenting and noting appearances, but failed to obtain any but the vaguest conception of the nature of the power. In 1733, C. F. Dufay, a distinguished French investigator, announced a theory of two electric fluids, one of which was developed by the rubbing of glass and similar substances, and named by him *vitreous*; and the other by rubbing amber and resinous substances, and named *resinous*. There were, then, he maintained, two kinds of electricity, and two bodies charged with the same kind repelled each other, but two charged with opposite kinds were mutually attractive. In accordance with this double-fluid hypothesis, which met with considerable support, these two fluids are supposed to be present in equal quantities and combined together in a neutral body—that is, a body apparently possessing no electric power. Friction has the effect of separating them, and giving one fluid to the rubbing body, and the other to that rubbed. When a body, possessing electricity of one sort, is brought near to an insulated conductor, the neutral fluid upon it is, as it were, decomposed. The kind of electricity opposite to that in the inducing body is attracted towards that body, while the opposite kind is repelled as far as possible from it. For nearly twenty-five years this hypothesis found acceptance; then Franklin, the great American, who proved that a flash of lightning and an electric spark were identical in nature, suggested the existence of a single homogeneous imponderable fluid of extreme tenuity and elasticity, in a state of equal distribution throughout the material world. This fluid is assumed to be repulsive of its own particles, but attractive of all other matter. When distributed in bodies, in quantities proportionate to their capacities or attraction for it, such bodies are said to be in their natural state. When we increase or diminish the natural quantity of electricity in any substance, excitation is the result, and the substance, if overcharged, is said to be electrified *positively*, or, if undercharged, *negatively*. These terms are retained, although the sense in which they are used is not precisely that given to them by Franklin. The action of the electric force—or rather of the true opposing manifestations of force, by whatever name we call them, *vitreous* and *resinous*, or *positive* and *negative*—may be exhibited by a familiar little experiment. But we must premise that the mysterious force will travel rapidly through some substances, which are therefore known as *conductors*, and very unreadily (practically, not at all) through others, known as *non-conductors*. The metals are conductors, and silk, glass, resin, amber, and various other substances are non-conductors. No electricity will remain in a body connected with a conductor which carries it away as fast as produced, and that is the reason why the well-known metallic rods, lightning conductors, carry off the electricity in the atmosphere, otherwise dangerous, and get rid of it in the earth. Understanding that, we shall the better understand the experiment we have mentioned. A light pith-ball or a feather is suspended by a silk thread, which is a non-conductor, and therefore impervious to electricity. A glass tube smartly rubbed with a silk handkerchief becomes charged with vitreous electricity, and if then brought near to the pith-ball, or feather, that is briskly attracted towards it, but in a moment a contrary action takes place, and it is as smartly repelled. The fact is, it has become charged with the same kind of electricity as the tube itself, and the similarity produces antagonism. If a piece of sealing-wax is then excited by rubbing, and so charged with resinous electricity, and presented to the pith-ball, or feather, attraction and repulsion again take place, as when the glass was used. This may be done over and over again, and we readily arrive at the conclusion that similarly electrified bodies repel each other, and dissimilarly electrified bodies attract each other. If the electrified pith-ball be touched with any conductor in communication with the ground, it will instantly lose its charge of electricity, which will be carried back to the great natural reservoir of the force, on the lightning conductor principle. We may just observe that friction develops both kinds of electricity, the rubber and the rubbed body assuming opposite states. The electric force always seeks to pass from one to the other, and so restore the equilibrium, and the end of one of the wires connected with an electric machine is known as the positive pole, and the end of the other as the negative; and when the two are connected a circuit is established, and when separated by a small space the electric force makes great effort to complete the circuit by passing from one to the other.

The positive electricity so striving to unite with the negative takes the form of a spark, the intense force developing combustion of the intervening atmosphere. Electricity, then, is a force; not a visible fluid, like water, nor an invisible fluid, like gas, but simply a force, undefinable in its nature, and recognisable only by its stupendous results. Electrical action can be produced by friction, by the action of certain acids upon metals, and by the very rapid motion of metals in the immediate vicinity of magnets. The first kind of action is known as *frictional*, the second as *voltaic*, and the third as *magneto-electricity*. Frictional electricity is that exhibited in the experiment we have mentioned, and in the machines constructed with glass cylinders with which most of us are acquainted; voltaic electricity is developed in the galvanic battery, a series of metal plates immersed in various solutions, in extensive use in connection with telegraphic apparatus, and also tolerably well known; and the third, magneto-electricity, is that produced by the Gramme and other electro-dynamic machines so much talked of in connection with the introduction of the electric light. We need but add that the magnetic and electric forces are proved to be identical and that a reciprocal action is established—that is, that a bar of iron around which a wire is coiled becomes a magnet when a current of electricity is passed through the wire, and has positive and negative poles or ends; and, on the other hand, a coil of wire becomes electrified if a powerful magnet is placed in the centre, or revolves with great velocity near it, or if the coil revolves near the magnet. It will be more convenient to reserve more detailed explanations on some of these subjects for special articles under the headings ELECTRIC LIGHTING, ELECTRO-DYNAMIC MACHINES, and MAGNETO-ELECTRICITY.

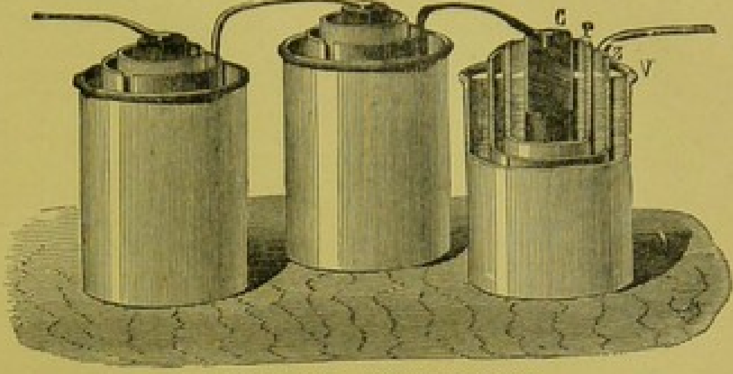
Frictional Electricity.—This name must be taken as describing one method of exciting electrical energy, not as an energy of a different kind. Some bodies which do not conduct electricity—that is, through which the force does not pass—are capable of electrical excitation from friction, and are in consequence termed *electrics;* other bodies, through which the force passes, are conductors, cannot be excited by friction, and are known as *non-electrics*. If a stick of sealing-wax be rubbed with a dry piece of flannel or cloth, it becomes electrified, in other words, it acquires the power of attracting light bodies, as feathers, wafers, or bits of paper. Many other substances besides sealing-wax can be readily electrified by friction. The kind of electricity resulting from friction appears to depend on some peculiar condition of contact between the rubbed surfaces; thus smooth glass rubbed with silk or wool becomes positive, but when roughened by sand or emery it acquires, under the same circumstances, a negative charge. Again, when silk is rubbed with glass, it becomes negative, but when rubbed with sealing-wax, positive. If a warm and a cold surface be rubbed together, the colder becomes positively electrified, the other, negatively. When two silk ribbons are rubbed across each other, that which is longitudinally rubbed becomes positively electrified; and when a white ribbon is rubbed by a black one, the white ribbon becomes positive. Both kinds of electricity are produced in every case of electrical excitation, the rubber and the rubbed body always assuming opposite states; in fact, both electricities are produced together, and in exactly equal amounts. When the electricity is produced by friction upon glass, it remains where it was produced, *insulated*, and exhibits its effects of attraction and repulsion towards external objects; but if it be produced on such a body as a rod of iron held in the hand, it is transferred through the iron to the hand, thence through the body to the earth. If, however, the iron rod be cemented to a stick of glass and thus supported, it can readily be electrified by friction. The following is a list of various substances, arranged so that if any two of them be rubbed together, the one which stands nearest to the beginning becomes positively electrified, the others negatively:—

Cat's Skin.	Glass.
Flannel.	Cotton.
Ivory.	Silk.
Rock Crystal.	The Hand.
Wood.	Sulphur.
Shellac.	Caoutchouc.
Resin.	Gutta Percha.
Metals.	Gun Cotton.

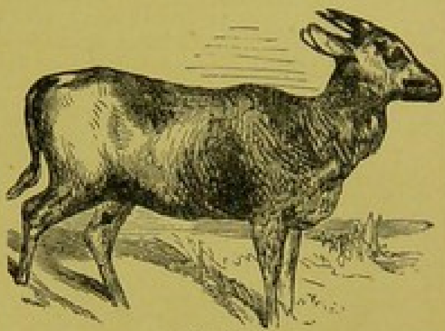
Before the recent applications of the electric force to the practical arts, and so long as electrical science was limited to the laboratory or lecture-room, friction was one of the chief modes—indeed, the chief mode of producing the exhibition of the phenomena. *Cylinder and Plate Electric Machines* were those chiefly employed. The cylinder machine consists of a glass cylinder supported by means of a horizontal axis on two wooden uprights, and made to revolve rapidly by means of a winch. Two brass cylinders of smaller diameter are placed on each side of, and parallel to, the glass cylinder, and supported on glass pillars. To one of the brass cylinders is attached a cushion as long as the cylinder itself, made of horse hair, and covered with leather, made, by means of a spring or screw, to press against the glass cylinder. To the lower end of the cushion is attached a long flap of silk, which, when the machine is at work, passes between the cushion and the glass cylinder, over which it lies, covering the whole upper half. That portion of the silk which covers the cushion is spread with "electric amalgam," a compound of tin, zinc, and mercury, in the respective proportions of 1, 2, and 6. The other brass cylinder, the "prime conductor" of the machine, is furnished with a horizontal row of pointed wires, like a comb, with intervals of half-an-inch between the teeth, which project towards the glass cylinder, approaching as nearly as possible without touching it. When the glass cylinder is turned, it becomes positively, and the cushion negatively, electrified by friction. The positively electrified glass is carried round till it comes opposite to the points belonging to the prime conductor, which becomes excited by induction (*see* below, INDUCTION), and, in fact, is electrified negatively on the side nearest to the glass, and positively on the side opposite to the glass. But the points have no power to hold a charge, and they discharge towards the glass cylinder, permitting negative electricity to flow from themselves towards it, and thus they neutralize the positive electricity on it, and leave the prime conductor charged with positive electricity. A spark of positive electricity can now be obtained from the prime conductor. But during this time the cushion has, as we have mentioned, been charging with negative electricity, and when it has attained a certain degree of electrification, it is necessary to discharge it before any more positive electricity can be obtained from the prime conductor. It is usual to connect the cushion permanently by means of a chain or wire to the earth, and then, on turning the machine, a continuous discharge of positive electricity can be got from the prime conductor. The *Plate Electric Machine* is the same in principle as the cylinder machine; but, instead of a glass cylinder, a circular glass disc or plate is used. In some of the improved forms the prime conductor is a large brass ball. The friction caused by steam at high pressure issuing from a narrow pipe develops electricities on the steam and pipe which depend on the material of the latter. An accidental injury to a workman directed the attention of Mr. (afterwards Sir William) Armstrong to this fact, and he designed a *Hydro-Electric Machine*, consisting of an ordinary steam boiler, insulated on four glass legs. To the escape-pipe a row of nozzles were attached, constructed so as to give as much friction as possible to the steam rushing out through them. Round the nozzles was a box of cold water, in order that the steam, after passing through it, might issue from the nozzles charged with vesicles of water. The steam was charged with positive electricity, the boiler with negative; and the electricity of the steam was given up to the points and prime conductor.

Voltaic Electricity, or Galvanism.—Electric currents are obtained by chemical action, especially that attending the dissolution of metals. When two plates of

ELECTRIC EEL.



ELECTRICITY.—BUNSEN BATTERY.



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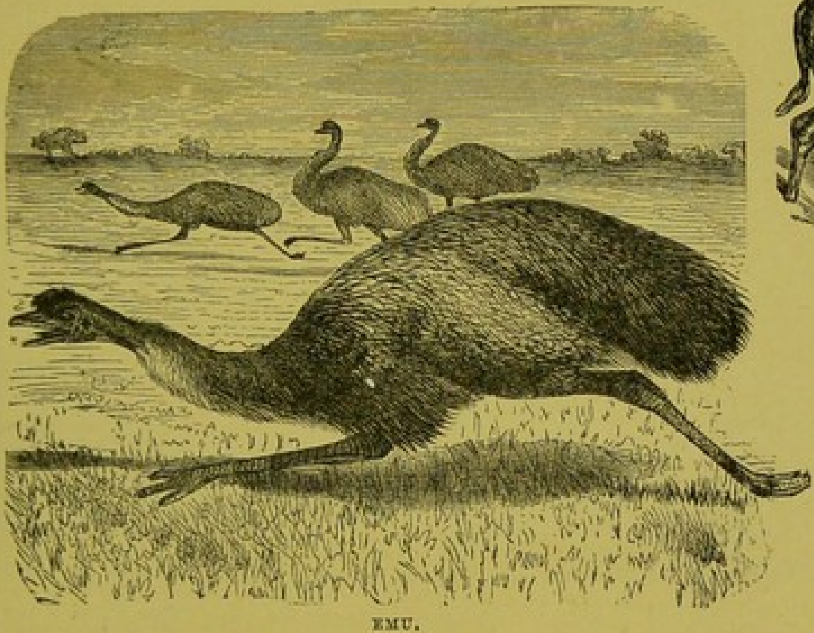

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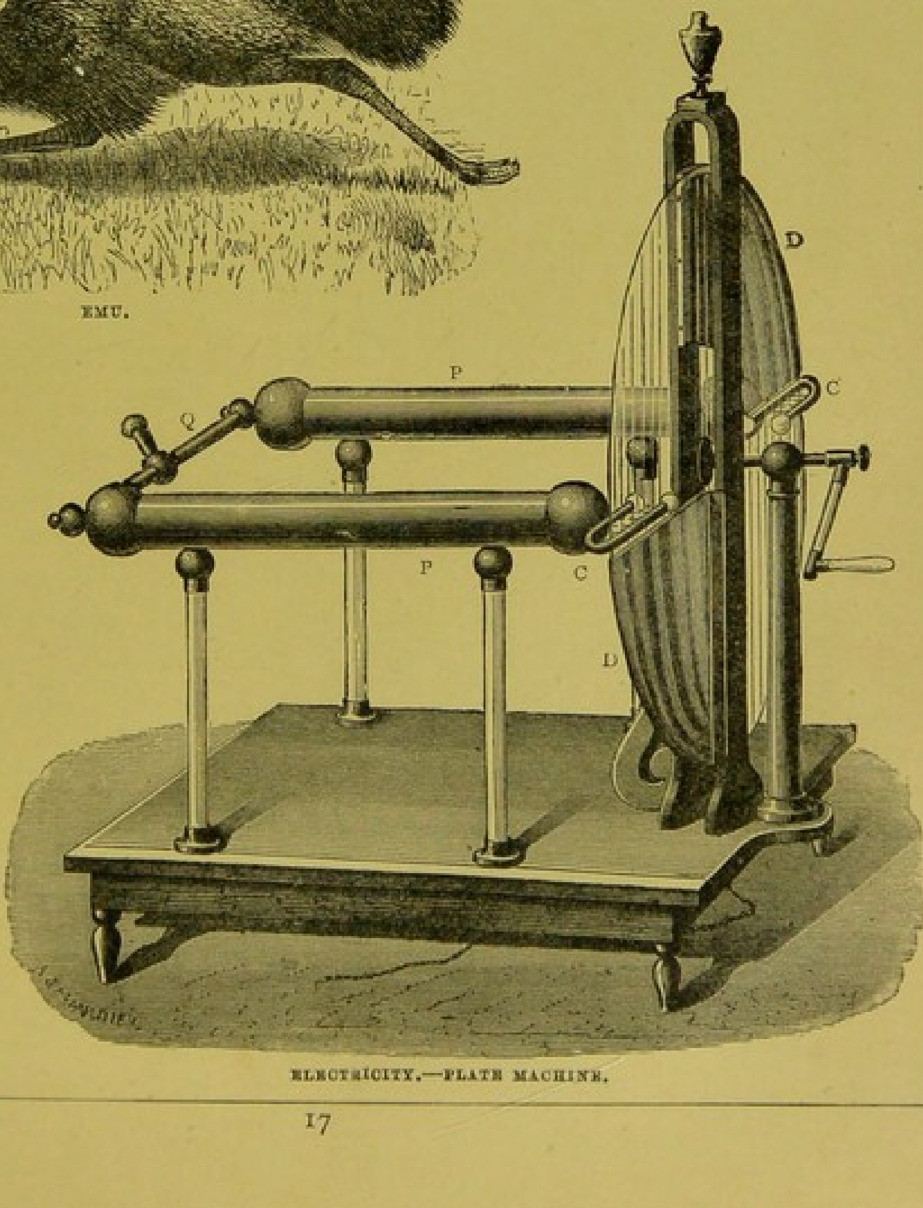
ELECTRIC LIGHT.—
JABLOCKHOFF CANDLES.



ELECTRICITY.—PLATE MACHINE.

copper and zinc (the surface of which has been rubbed over with mercury) are placed in a vessel containing water, to which a small quantity of sulphuric acid has been added, and the plates are made to touch, bubbles of hydrogen gas are formed in abundance at the copper plate, and their formation continues until the plates are again separated; and if wires of copper or any other conductor of electricity be attached to the plates by solder or binding screws, and be made to touch, the same results occur. The fact is, there is an excitement of electrical power; and the two plates, with the wires, form a cell, and a number of these cells a battery, from which powerful electric currents can be obtained. Such a battery is of great value, and is in constant employment in arts and manufacture. For more extended information on the subject, see GALVANISM.

Other Sources of Electricity.—Besides friction and chemical dissolution of metals, there are other methods of inducing electrical action. After cleavage or pressure, certain laminated minerals, such as mica, arragonite, or calcareous spar, exhibit strong electrical excitement at the surfaces cleft or pressed, one of these surfaces being always positive and the other negative; and many other bodies, not minerals, possess the same property. Thus, if a disc of cork and a disc of caoutchouc be pressed together and then separated, the former is found to be electrified positively and the latter negatively. Change of temperature also produces electric excitement. If a crystal of tourmaline be warmed, it shows positive electricity at one extremity of its principal axis and negative at the other, and if it be broken during the heating, each of the parts is electrified at each end, just as the whole was, showing apparently that the crystal possesses electric polarity analogous to the polarity which a magnet has. Topaz, boracite, and some other minerals exhibit similar action under the influence of heating. Electricity is also obtained by the action of heat to a junction of two dissimilar metals. (*See* THERMO-ELECTRICITY.)

Positive and Negative Electricities.—The absolute inability of the most acute investigators to define the real nature of the electric energy compels them to use terms which to a certain extent have a definite meaning for practical purposes, but which are by no means scientifically correct. It has already been shown that Franklin adopted the words *positive* and *negative* in place of the *vitreous* and *resinous* of the earlier investigators. The fact that electricity developed on glass by friction with silk will attract electricity developed on wax by friction with flannel is indubitable; so also is the fact that electricity of either kind will repel its own kind. But, even so far, the subject is surrounded with difficulty; and we are unable to distinguish the essential difference between the so-called vitreous and resinous electricities; for "we may get from glass the same electricity (that is, electricity acting in the same manner) as we do from wax if the glass be ground and rubbed with flannel instead of silk; or even by holding an ordinary glass tube in an alcohol flame, it becomes negatively electrified." The hypothesis, indeed, is a remainder of the "two-fluid theory." A recent clever writer on the subject, Mr. Thomas Dunman, says, "It must be thoroughly understood that this theory or hypothesis is rather an *expression* than an *explanation* of the phenomena of electricity, and must by no means be regarded as a final and thorough solution of the various features, but rather should be looked upon as an hypothesis which is temporarily made use of until some more comprehensive and trustworthy theory shall take its place." We require, probably, to know something more of the amount of heat generated by friction, of the conversion of such heat into energy, and of the phenomena of polarization before we can hope to arrive at a satisfactory solution of the problem. Modern electricians appear, while adopting Franklin's selection of the terms *positive* and *negative*, to have so far added an acceptance of his views regarding abundant and deficient energy as to indicate *positive* electricity by the plus sign (+), and *negative* by the minor sign (—).

Conductors and Non-Conductors.—It has been already stated that the electric energy passes with great rapidity and ease through some substances and disappears, while other substances retain it. The former are known as *conductors*, the latter as *non-conductors*. When a conducting substance is insulated—that is, separated from the earth (to which electricity is always trying to return) by the interposition of a non-conducting substance, such as glass—it is perforce retained, being unable to escape, but may be "drawn off," as it were, by bringing a conductor into contact, or very near proximity. The electricity developed in a glass cylinder by friction (as explained above), passes readily into the brass conductors, because metals are conductors, but goes no farther, because the brass cylinder is insulated by being mounted on a glass tube. If, however, a person presents his knuckle to the knob of the brass conductor, electricity passes in the form of a spark, because animal substances are conductors. The imprisoned energy seizes the opportunity of regaining the earth through the human body, and what is known as a "circuit" is completed. What that means will be presently explained.

Conductors and Non-Conductors.—Some bodies appear on a cursory examination to offer no obstacle to the passage of electricity through them, and such bodies are known as *conductors*; others seem to be impervious to the transmission of the energy, and are styled *non-conductors* or *insulators*. Strictly, however, no body is a perfect conductor, permitting the electricity to pass without resistance, nor is there any perfect insulator, and there is no line where conductive power can be said to cease, and insulating power to begin. In the article already quoted, Lord Bury says: "It is only a question of degree. Even the best conductor offers a certain amount of retardation; and the worst conductor known is permeable in time, and does not afford perfect insulation. To be sure, the limits of variation in this respect are wide enough. An uncovered wire of copper will allow a current to move along it at the rate of 288,000 miles a second, and it would take minutes, and perhaps hours, to creep over an inch or two of gutta-percha. Still, as a mathematical fact, neither insulators nor conductors are perfect." Conductors have been defined as bodies whose molecules have the power of communicating their electricities to each other with great ease, whilst non-conductors are those whose molecules only acquire this power under great force. Practically, bodies may be classed as conductors through which the electric force is transmitted with great rapidity; semi-conductors, or slow-transmittors, and non-conductors, which are, if not strictly, yet for all practical purposes insulators.

Conductors.—Metals, gas carbon, graphite, acids, aqueous solutions, water, vegetable substances, animal substances, soluble salts, linen, cotton.

Semi-Conductors.—Alcohol, ether, powdered glass, flowers of sulphur, dry wood, ice at freezing point.

Non-Conductors.—Dry oxides, ice at 13 degrees below zero, fatty oils, caoutchouc, air and gases, dry vapours, silk, diamond glass, wax, sulphur, resin, amber, shellac, paraffin, gutta-percha.

Electric Induction.—Free electricity has the power of inducing the bodies in its neighbourhood to assume a peculiar electric condition. To show the inductive action, let an insulated and positively charged conductor be brought into the vicinity of another conductor, likewise insulated, but uncharged. If the latter be furnished with pith-ball indicators at each end, they will be seen to diverge more and more as the charged body approaches; and on examining the ends it will be found that the side of it nearest to the charged body is negatively, and the remote side positively electrified. If the charged conductor be either removed or discharged, the disturbance ceases, and the original neutral condition of the other is restored. Thus it appears that an uncharged conductor, under the influence of an electrified body, assumes an excited state, one side of it being electrified similarly, the other oppositely to the charged body. This propagation of electric force across a non-conducting medium is called *induction*. If, instead of one uncharged insulated conductor, a number are used, the action is carried on from one to the other. The positive electricity at the end of the first row acts by induction on the next, and makes the near end negative, the remote end positive. The action is propagated still farther, and, finally, the last of the row is affected, the side nearest the last but one is electrified negatively, the remote side positively. Nor does the action stop here, for the positive electricity, thus developed at the remote end of the row, acts inductively towards all the surrounding objects—it may be the floor, walls, and ceiling of an enclosing chamber, or it may be the surface of the earth, the trees, the clouds, "perhaps even towards the remotest star," where no conductors intervene. Faraday originated the theory now generally accepted, that induction is not the direct action of one body on another, but an action transmitted through, or possibly residing in, the medium (*dielectric*) between them. It is shown by experiment that the action takes place through air in curved as well as in straight lines, which implies the action of an intervening medium. The relative powers of different substances in facilitating induction are termed their *specific inductive capacities*. The effect of induction on wires in proximity will be noticed under the head TELEGRAPH, ELECTRIC.

Electric Current.—To explain what is meant by an electric current, let us suppose a wire connected with the ground to be applied to the prime conductor of an electric machine while it is being worked. The prime conductor is thus discharged, and, according to common phraseology, the electricity passes through the wire to the ground, the passage of the electricity being called an electric current. The existence of a current can be ascertained and its strength measured by its action on a magnetized needle suspended in its vicinity. When a magnetized needle is capable of turning about an axis perpendicular to its length, as is the case with a common compass needle, and is brought near to a wire through which a current is passing, the needle tends to turn its length at right angles to the direction of the current. It is upon this principle that the *galvanometer*, or current measurer, is founded.

Electric Circuit.—The whole system over which a current passes is called a circuit. A *closed* circuit is when the way is continuous throughout, however many interpolations of extraneous resistances it may contain; an *open* circuit is when, either by design or accident, the continuity of the conductor is destroyed.

Electrical Resistance.—The opposition offered by every constituent part of a circuit to the passage of a current and by work to be performed.

Measurement of Electric Force.—There are four electrical elements capable of measurement—strength of the current, electro-motive force, resistance and quantity. Electricians have fixed as a *unit* of measurement the force capable of raising one gramme in weight through one metre of height in one second of time. A committee of the British Association established the series of standards now in general use, and gave to the new measures the names of eminent electricians. The unit of electro-motive force is known as a *volt*, from Volta, the great discoverer of voltaic electricity. The standard of resistance is an *ohm*, from the discoverer of the law known as Ohm's law, that "the intensity of a given current is equal to the electro-motive force of the battery, or generating machine, divided by the total resistance of the circuit." An ohm corresponds to the resistance of an iron wire four millemetres in diameter and about a hundred metres in length—the French decimal system of measures being adopted for the convenience of electricians of various nations. *Resistance coils* of platinum silver wire are prepared by which the number of ohms of resistance can be ascertained. Each coil opposes one or some definite number of ohms resistance to the passage of a current, and is marked with the proper number. All electrical resistances are now habitually measured in ohms. The intensity of a current is measured by *ampères*, named after M. Ampère, the French electrician. The quantity of electricity forced through the resistance of one ohm by a current with the intensity of one ampère is known as a *coulomb*. The name *weber* was, until very recently, given to the measure of intensity and quantity combined, but is now disused.

History of Electrical Discovery.—The ancients were well acquainted with the fact that certain bodies, when rubbed, acquire the power of attracting light particles of matter. Thales of Miletus, the founder of the Ionic philosophy, who flourished some 600 years before the Christian era, developed this attractive property in amber by friction, and concluded that the substance was animated by an unknown spirit or element. Theophrastus, some centuries later, observed the same attractive property in a crystal termed the lyncurium, now supposed to be the tourmaline. Pliny and other naturalists refer to the attractive power of amber as something well known, but say nothing to lead us to suppose that their knowledge of electrical phenomena went beyond the discoveries of the old philosophers. The first attempt towards a generalization of electrical phenomena was made near the close of the 16th century, by Dr. William Gilbert, in a treatise on the Magnet. In the following century, Dr. Wall, Boyle, Newton, and others, accumulated many new facts; but these were not of a nature to lead to the discovery of general principles. The electric spark was first noticed by Dr. Wall. In the early part of the last century, Dr. Hauksbee made many electrical experiments, from which he ascertained that glass was a substance which could be readily electrified by friction; and that some other bodies, especially metals, treated in the same manner, manifested no electrical power whatever. In 1728, Mr. Stephen Grey, a pensioner at the Charterhouse, performed a number of experiments which led to the discovery of electrical conduction, and to the classification of bodies into conductors and non-conductors. The conclusions arrived at by Grey were firmly established by the brilliant researches by Du Fay. In 1745 and 1746, numerous attempts were made to confine electricity in glass vessels containing water or mercury; and, almost simultaneously, Von Kleist, in Germany, and Cunæus, in Holland, became acquainted with the disagreeable effects of the electric shock. Muschenbroek, of Leyden, repeated the experiments of Cunæus, and published a wonderful report of the effects of the shock received from the apparatus, which is still known as the Leyden jar or phial. The discoveries of Franklin followed soon after, and greatly advanced the science of electricity. By a series of experiments with a common kite, he ascertained what had been before conjectured, that lightning was an electrical phenomenon. Cavendish afterwards entered with great spirit into the field of electrical research, and thoroughly investigated the conditions of bodies charged with electricity. In 1787, Coulon, by means of his torsion balance, investigated the laws of electric attraction and repulsion. About the year 1789, Galvani, of Bologna, discovered that the mere contact of metals with the muscles and nerves of a frog recently killed produced convulsive motions; and, by repeating Galvani's experiments, the celebrated Volta, a professor of natural philosophy at Pavia, was led to the discovery of the apparatus now known as the Voltaic pile, a discovery which gave rise to a new branch of electrical science, which is termed galvanism, or, more correctly, Voltaic electricity. Davy's researches proved that the Voltaic current was a most potent agent in chemical analysis. Oersted discovered, in 1820, that the current exerted a peculiar influence on the magnetic needle, and founded the science of electro-magnetism, which was soon afterwards fully developed by Ampère. Faraday, in his "Experimental Researches in Electricity," published between 1830 and 1840, described the phenomena of Volta-electric and magneto-electric induction, and thus established the beautiful science of magneto-electricity. Seebeck, of Berlin, found that an electric current may be generated by the unequal effects of heat on different metals in contact, and gave the name of thermo-electricity to the new branch of science which sprung from this observation. Among the more eminent modern electricians are Wheatstone, Grove, Becquerel, Jacobi, Daniell, Smee, Bunsen, Ruhmkorff, Siemens, Sir William Thomson, Tyndall, Gramme, and Edison.

ELECTRICITY, ANIMAL.—Various kinds of fishes possess organs capable of developing electric force. The species which has been longest known, and to which the popular name of torpedo has been given is the *Raia torpedo*, or electric ray. (*See* TORPEDO.) The *Gymnotus electricus*, or electric eel, is an extraordinary fish, an inhabitant of the fresh-water lakes and rivers of the warmer regions of America, Africa, and Asia. A specimen more than three feet in length was preserved alive in London between the years 1838 and 1842, and was examined by a great many electricians. It has the power of giving electrical shocks, which power it exerts for killing or stunning the fishes upon which it feeds. Its body is smooth and without scales. A long ventral fin extends from behind the head to the extremity of the tail; the mouth is armed with sharp teeth, and projecting into it are numerous fringes, that, from their nature, appear to serve a purpose in respiration. The gullet is short, terminating in a capacious stomach. The electrical organs are situated on each side, and consist of flat partitions or septa, and cross divisions between them. The outer edges of these septa appear, when the skin of the body is turned over, in parallel lines, nearly in the direction of the longitudinal axis of the body. They are thin membranes nearly parallel to one another, their breadth being nearly the semi-diameter of the body. A powerful shock is felt when one hand is placed near the head and the other near the tail. By the electricity generated by the specimen exhibited in England, Faraday magnetized steel needles, and decomposed iodide of potassium with the greatest ease. A single medium discharge from the animal is calculated to be equal to the electricity of a Leyden battery of fifteen jars, containing 3,500 square inches of coated glass, charged to the highest degree. The *Malapterurus electricus*, found in the Nile, called by the Arabs, "the thunder-fish," averaging about ten or twelve inches in length, and a smaller fish of the same genus, the *M. Beninensis*, of the Old Calabar river, West Africa, possess considerable power of developing electricity. The late Professor George Wilson, in a paper in the *Edinburgh Philosophical Journal* for October, 1857, expressed the opinion that in ancient times it was a common practice to use electrical fishes as remedial agents. Between 1786 and 1794, Galvani made important discoveries referring to the electric properties of the muscles and nerves of animals (*see* GALVANISM); and Matteuci, an Italian investigator, and Dubois Reymond, a German, have demonstrated that there is a "muscular current" in living animals.

ELECTRICITY, ATMOSPHERIC, the term applied to electricity as a natural agent existing and acting in the atmosphere. Electricity is called into action upon a grand scale in the thunderstorm. The beautiful phenomena of the aurora borealis is connected with, or dependent upon, atmospheric electricity. (*See* AURORA BOREALIS.) All meteors were at one time considered as derived from electricity; but the showers of stones by which many of them are accompanied show that they must be ascribed to other sources. (*See* METEOR, METEORIC STONES.) It may be almost certainly assumed that the magnetism of the earth acts on the electricity of the atmosphere. At present it would appear that between the atmosphere (itself affected by solar influences) and the earth, there is a continual interchange of magnetic and electrical action, and that light and heat are important factors in the solution of the great problem. (*See* TERRESTRIAL MAGNETISM.)

ELECTROLYSIS, *e-lek-trol'-e-sis* (Gr., *elektron*, amber; *luo*, I loose), a term applied by Faraday to the process of electro-chemical decomposition. The voltaic current has the power of loosening and separating the elements of certain compounds when these are interposed in the circuit. The substances which are thus susceptible of decomposition are termed *electrolytes*. The amount of electrical power required to effect decomposition varies greatly with different electrolytes: solution of iodide of potassium, melted chloride of lead, hydrochloric acid, water mixed with a little sulphuric acid, and pure water, demand very different degrees of decomposing force, the resistance increasing from the first-mentioned substance to the last. One of the indispensable conditions of electrolysis is fluidity; for bodies which, when reduced to the liquid state by fusion or solution, freely conduct electricity and readily suffer decomposition, are frequently absolute insulators when solid. The decomposition of water by the voltaic current was first observed by Messrs. Nicholson and Carlisle, and their discovery caused a great sensation in the scientific world. The researches of Davy on the chemical effects of the current led soon after to the great discovery that the alkalies, soda and potassa, and the earths, which had hitherto been regarded as elementary bodies, contained metals. This discovery, which was announced in 1807, proved that the voltaic pile was an instrument of immense importance in chemical investigations. To Davy's great pupil and successor, Faraday, the world is indebted for the elucidation of beautiful phenomena attendant on electrolysis. From a very extended series of experiments he was enabled to draw the general inference that the effects of chemical decomposition were always proportionate to the quantity of circulating electricity, and might be taken as an accurate and trustworthy measure of the latter. Guided by this important principle, he constructed his *voltameter*, an instrument which has rendered the greatest service to electrical science. This is merely an arrangement by which a little acidulated wate, is decomposed by the current, the gas evolved being collected and measured. By placing such an instrument in any part of the circuit, the quantity of electrical force necessary to produce any given effect can be at once estimated; or, on the other hand, any required amount of the latter can be, as it were, measured out and adapted to the object in view.

ELECTRO-MAGNETISM, *e-lek'-tro-mag'-ne-tizm*, an important branch of electrical science, which may be said to have sprung from a discovery made by Professor Oersted, of Copenhagen, in the year 1820. The discovery of the Danish philosopher was thus simply stated:—When a properly-balanced magnetic needle is placed in its natural position in the magnetic meridian, immediately under and parallel to a wire along which a current of voltaic electricity is passing, that end of the needle which is situated next to the negative side of the battery immediately moves to the *west*; if the needle is placed parallel to and over the wire, the same pole moves to the *east*. When the uniting wire is situated in the same horizontal plane as that in which the needle moves, no declination takes place; but the needle is inclined, so that the pole next to the negative end of the wire is depressed when the wire is situated on the west side, and elevated when situated on the east side. By this discovery the relation of magnetism to electricity, which had long been suspected, was satisfactorily established, and a new and boundless field of research was opened. A consideration of the influence exerted by electrical currents on magnets naturally led to the conclusion that the neutral condition of bodies susceptible of magnetism would be disturbed by an electrical current, and this conclusion was quickly verified by experiments. When an electrical current is passed at right angles to a piece of iron or steel, the latter acquires magnetic polarity, either temporary or permanent, as the case may be, the direction of the current determining the position of the poles. This effect is prodigiously increased by causing the current to circulate a number of times round the bar, which then acquires extraordinary magnetic power. A steel bar may be permanently magnetized in this way, but a bar of pure and soft iron retains the magnetic force only so long as the electrical current is circulating round it. Bars of iron thus temporarily magnetized are called *electro-magnets*. (*See* MAGNETISM and TELEGRAPH.)

ELECTROPHORUS, *e-lek-trof'-o-rus* (Gr., *elektron*, and *phoreo*, I bear), a valuable instrument for exciting electricity, devised by Volta. In the chemical laboratory it is generally used instead of an ordinary electrical machine for charging small Leyden jars, when mixtures of gases have to be exploded by the electric spark. To construct it, a plate of tin is made into a circle of about twelve inches diameter; a raised border is then turned up for about half an inch, and the extreme edge is turned outwards over a wire, so as to avoid a sharp border. A mixture of equal weights of shellac, Venice turpentine, and resin, is made by gently heating them together until well fused, stirring during the time with a stick, so as to thoroughly incorporate the ingredients. The composition should, when perfectly homogeneous, be poured into the plate with the raised edges until it is quite full, and the composition is to be kept melted, but not too hot, until the bubbles have entirely disappeared. The second portion of the instrument, or that which serves the place of a conductor, consists of a flat circle of wood, rounded at the edge, and neatly covered with tin-foil: it is rather smaller than the resinous plate. An insulating handle, formed of a piece of stout glass rod, is cemented into the centre of the wooden disc.

ELECTRUM, *e-lek'-trum* (Gr., *elektron*, amber), a term used by the Greeks to denote amber, and applied by the Romans to this substance and to an alloy of gold and silver containing three or four parts of the former to one of the latter. At the present day the term is often used to denote native gold associated with silver.

ELECTUARY, *e-lek'-tu-a-re* (Lat., *eligo*, I make choice), a form of preparing certain remedies, such as dry powders, by forming them into a soft mass by means of syrup or honey.

ELEMENTS, *el'-e-ments* (Lat., *elementum*), in Chemistry.—An element may be defined as a substance which cannot be resolved into others. The ancient philosophers imagined earth, air, fire, and water to be elements, by the combination of which all other substances were formed. Modern chemistry has, however, proved that air, earth, and water are compound bodies, and that fire is an effect, and not a substance. The number of substances which cannot be further resolved by chemists are provisionally termed by them elements, it being by no means improbable that many of them are compound bodies. In the present state of knowledge, they are 64 in number, and are divided broadly into the non-metallic and metallic elements; these two divisions somewhat running into each other. The following is a list of the elements divided in this manner:—

Non-Metallic, or Metalloid.

Boron.	Hydrogen.	Selenium.
Bromine.	Iodine.	Silicon.
Carbon.	Nitrogen.	Sulphur.
Chlorine.	Oxygen.	Tellurium.
Fluorine.	Phosphorus.	

Metallic.

Aluminium.	Gold.	Rubidium.
Antimony.	Indium.	Ruthenium.
Arsenic.	Iridium.	Silver.
Barium.	Iron.	Sodium.
Bismuth.	Lanthanum.	Strontium.
Cadmium.	Lead.	Tantalum.
Cæsium.	Lithium.	Terbium.
Calcium.	Magnesium.	Thallium.
Cerium.	Manganese.	Thorinum.
Chromium.	Mercury.	Tin.
Cobalt.	Molybdenum.	Titanium.
Columbium (or Niobum).	Nickel.	Tungsten.
Copper.	Osmium.	Uranium.
Didymium.	Palladium.	Vanadium.
Erbium.	Platinum.	Yttrium.
Glucinum.	Potassium.	Zinc.
	Rhodium.	Zirconium.

The metallic elements are generally, but not invariably recognised by the power of reflecting light and conducting heat and electricity. At ordinary temperatures, oxygen, hydrogen, nitrogen, chlorine, and fluorine, are gaseous; bromine and mercury are fluid; the others are all solid.

In **Astronomy**, elements are those numerical quantities, obtained by observation and calculation, which are used in compiling tables that exhibit the ephemeris of a planet's motions. The principal are its greatest, mean, and least distance from the sun; its mean daily motion; its mean annual motion; the eccentricity of its orbit and its inclination to the ecliptic; the longitude of its ascending node and perihelion; and its mass and density.

ELEMI, *el'-e-mi*, a fragrant resinous substance obtained from different species of the natural order *Amyridaceæ*. It was formerly obtained from Egypt, but now chiefly from the tropical parts of America. It is soluble in alcohol, except a white, crystalline, inodorus residue known as *elemine*. Elemi is used in the preparation of medicinal plasters and ointments, and a volatile oil is obtained from it.

ELEPHANT, *el'-e-fant* (*Elephas*).—This is the largest of existing *Pachydermata*, and of quadrupeds classified in the section *Proboscidea*. In ancient times the most curious notions were entertained concerning it, not the least quaint being that it had no joints. Aristotle and Pliny were firm adherents to this doctrine. There can be little doubt that this delusion sprung from the fact that the elephant seldom lies down either in a wild or captive state. They have been surprised by hunters standing and yet fast asleep. Were the elephant's legs formed like those of other quadrupeds, the labour of raising his immense carcass from the ground might account for his dislike to a recumbent position; but his structure is such that lying down and rising are matters of but little difficulty. Instead of bringing his hind legs *under* him when he lies down, he extends them behind him, in the position of a kneeling human being; when he wishes to rise, he simply draws his hind feet gradually under him, and his enormous weight is levered up with perfect ease. This mobility of limb is of vast service to the elephant in the performance of his duty as a beast of burden; and with a *howdah* on his back containing eight or ten persons, and the driver on his neck, he can descend steep hills with perfect safety. He manages in this way: kneeling down at the commencement of the declivity, he puts out one fore-leg and feels cautiously for a safe footing; if he does not find it, he hammers at the soft soil with his heavy foot until he has made an indentation sufficient to secure firm footing. One foot thus accommodated, the other is drawn out with equal care, and provided for in the same manner as the first. Then one of the hind legs is cautiously drawn forward and one of the fore feet being released from the foot-hole, it is inserted in its place: and all this is performed so rapidly that it might be repeated at least three times in as little time as it takes to write this explanation. It is almost needless to observe that the elephant is distinguished by the possession of a long trunk or proboscis, which serves him in place of a hand, and enables him to perform many extraordinary feats. Without this curious appendage, he would find existence difficult, if not impossible. Elephants sometimes go blind while in a state of freedom, but, guided by this exquisite organ of touch, they are still enabled to make their way through dense forests, to gather food, and to avoid ditches and hollows. The elephant's trunk is not composed of a mere series of muscular rings, as its appearance would lead one to suspect. It has three perfect and distinct uses. As an organ of smell, it is an elongated and curiously elastic nose. Within it two canals are continued from the nostrils, which are reflected round the nasal bones and then proceed straight to its end. These canals are separated by, and imbedded in, a fatty elastic membrane containing thousands of minute muscles. Of these there are three sets—an outer longitudinal, composed of four layers; an oblique set, which are variously directed; and a third set, which radiate from the tubes to the circumference. They are very small, and supposed to number as many as forty or fifty thousand. Besides as an organ of smell, the elephant's trunk serves as a sucker, by which the great animal may quench his thirst at the shallowest pools. There is no passage from the trunk to the mouth; but the former may be filled, and then, the mouth of it being turned under and into the proper mouth of the elephant, the operation of drinking is accomplished. The elephant is very tenacious lest harm should come to this valuable organ. The dentition of the elephant is of a very remarkable nature. From the upper jaw extend two enormous teeth fixed in sockets in the front of the mouth, but which, in fact, are neither incisors nor tusks, although by the latter term they are generally known. They spring, however, from the intermaxillary bones, and must be regarded as the representatives of the incisors. They grow from a permanent pulp, and continue to increase in size during the life of the animal. The incisors are wanting in the lower jaw, as are also the canines in both jaws; and the only other teeth possessed by this immense quadruped consists of two molars of a most remarkable structure on each side of each jaw. These teeth are of a very large size, and a quadrangular form. They consist of a series of plates of the ordinary substance of teeth (*dentine*), each coated with a layer of enamel, and united together into a mass by a material called the *cement*. The form of these transverse plates of dentine and enamel varies greatly in the different species. The formation of the molar teeth, like that of the tusks, is going on as long as the elephant lives; but with this difference, that whilst after shedding the first or milk tusks, the pulp of each tusk continues adding matter to its base without any change, in the case of the molars it is a succession of separate teeth that is produced, the hindermost pressing gradually forward to take the place of those which have been abraded by use, and cast off as unserviceable. Elephants rarely breed in a state of domestication. The period of gestation of the elephant is a few days over twenty months. The breasts of the female are placed under the chest, and the young one sucks not with the trunk but with the mouth. The strongest proof of the elephant's antipathy to a recumbent position may be drawn from the fact that although the new-born calf is much too short to reach the teat, the mother, rather than lie down, will extend her legs so as to bring her breast nearer the earth. In a state of domesticity, the elephant-keeper will, under such circumstances, build a little platform of earth for the elephant-calf to stand on while it sucks. At its birth, the calf is about thirty-six inches in height. There are two living species of the genus Elephas—the Indian (*Indicus*) and the African (*Africanus*). The latter is confined to the central and southern parts of Africa, and is distinguished from the former by the convexity of its forehead, the enormous size of its ears, and the lozenge-shaped arrangement of the dentine and ivory in its molar teeth. The Indian or Asiatic elephant has the forehead concave, the ears of moderate size, and the dentine and enamel of the teeth arranged in transverse bands. It differs likewise from the African species by the paler brown of the skin, and in having four nails on the hind feet, instead of three; and its tusks are smaller, although in size and weight the Indian elephant exceeds the other. The tusks are valuable. (*See* IVORY.) It is conjectured that elephants attain their full growth at about their twentieth year. Their size has been greatly exaggerated. It is now pretty certain that 10 feet is tall, and 13 feet an extraordinary height for one of these animals. It is a tolerably well-ascertained fact that the ordinary duration of life in these animals is from seventy to eighty years; but there are records of the elephant living to a much greater age. In the East, elephants are used to carry distinguished personages, in tiger-hunting, as beasts of burden, and to carry military stores. In the latter capacity they did good service in the Abyssinian wars. In ancient times they were employed in war.

Fossil Elephants. (*See* MAMMOTH.)

ELEPHANT, SEA. (*See* PHOCIDÆ.)

ELEPHANT'S FOOT, OR HOTTENTOT'S BREAD, a plant (*Testudinaria elephantipes*) of the natural order *Dioscoreaceæ*, growing in South Africa. The Hottentots eat the root stock, a large mass, somewhat resembling an elephant's foot in shape, covered with a soft cork-like bark. The name is also given for the same reason of resemblance to a genus of plants (*Elephantopus*) of the natural order *Corymbiferæ*, one species of which is used medicinally in India in affections of the urinary organs.

ELEPHANTIASIS, OR BARBADOES LEG, *el-e-fan-ti'-a-sis* (Gr., from *elephas*, an elephant), is the name of a disease common in the East and West Indies, and so called from the skin of the afflicted limb becoming rough, scaly, and enormously thickened, so as to resemble the leg of an elephant. It generally comes on with great heat of the skin, alternating with profuse perspiration and ardent thirst. The part becomes red, hot, swelled, and painful, increases to great size, and becomes a burden to the patient. Though it is the leg that is generally affected by this disorder, other parts of the body are liable to its attack; but it is not usual for more than one part to be morbidly enlarged in the same individual. In the treatment of this disease in its earlier stages the use of laxatives and diaphoretics is recommended, together with the application of iodine ointment to the part, and firm bandaging.

ELEUSINE, *e-loo'-sine*, a genus of grasses, some of which are cultivated as grain in India and other hot countries. In Tibet a weak kind of beer is made from the *E. corocana;* and in Egypt a medicinal decoction of *E. Egyptica* is used as a remedy for diseases of the kidneys and bladder.

ELEVATION, *el-e-va'-shun.*—In Astronomy, the height above the horizon of an object on the sphere, measured by the arc of a vertical circle through it and the zenith.

ELEVATOR, *el-e-vai'-tor* (Lat.), in Anatomy, is a term applied to various muscles of the body, whose action is to lift up or elevate the parts to which they are attached; as the elevator muscles of the eye, mouth, &c. It is also the name given to an instrument in surgery, employed for raising depressed portions of the bones of the skull.

ELK, OR MOOSE DEER, *elk* (Sax., *elch*) (*Alces malchis*, or *Cervus alcos*), the largest of all the *Cervidæ*, or deer family, and common to the northern parts of both hemispheres. The antlers of this animal are comparatively short, but broadly dilated, and terminated by a numerous series of long points. When fully grown, these organs weigh from fifty to sixty pounds. The moose does not reach its full development till its fourteenth year, and then may be met with measuring six or even seven feet at the shoulders. Its legs are very long; its neck thick and short; its head elongated, and terminated by a broad muzzle. The coat of the moose is composed of long bristly hair, of a light ash-colour, and of a dark russet-brown on the surface. In the winter the coat of the bull moose changes to a glossy black. From behind the ears (which are large) down the neck and part of the back extends a mane, harsh and thick, and nearly a foot in length. The hair on the belly and inside the legs is sandy colour. Pendant from the spot where the junction of the head and neck occurs is a baggy pouch covered with long black hair, and known as the "bell." The ordinary food of the moose consists during the summer months of such leaves and tender branches as abound in its native forests. In the winter season it subsists on the tops of young shoots, pulling them into its mouth by its prehensile upper lip (or mouffle), and biting them off. Its flesh is highly esteemed as an article of food, especially when smoked or dried bacon-fashion. It is a swift and enduring animal, although its gait is clumsy and awkward in the extreme. The only pace of the elk is a long swinging trot; but its legs are so long and its paces so considerable, that its speed is much greater than it appears to be. The moose is a very wary animal, with an acute sense of smell, and is with difficulty approached by the hunter. The most successful way of hunting it is by "calling;" that is, imitating the trumpeting noise made by the female at the pairing season to attract the bull. Shy as the gazelle at other times, the bull moose swiftly obeys the invitation, and is thus brought within range of the rifle of the hunter, who is concealed in the thicket. The elk is easily domesticated, and at one time was employed in drawing sledges in Sweden, travelling at the rate of more than 200 miles in a day.

Fossil Irish Elks.—The bones of a large deer, *Megaceros Hibernicus* are found in the Pleistocene strata, in Ireland, and also in some parts of England, Scotland, the Isle of Man, and on the continent of Europe. The antlers were of enormous size, some skeletons having been found in which a straight line drawn between the extreme tips measured very nearly 11 feet. The weight of the antlers was in some cases over 80 lbs. The vertebræ of the neck and the limbs were necessarily very strong, to enable the animal to support so great a weight.

ELLAGIC ACID, *el-lai'-jik*, an insoluble acid found as a grey crystalline powder during the preparation of gallic acid from gall-nuts. It also occurs, in the intestinal concretions called bezoar-stones, found in the stomachs of the wild goats, antelopes, and deer of central Asia.

ELLIPSE, *el-lips'* (Gr., *elleipsis*), an oval curve, one of the conic sections. (*See* CONIC SECTIONS.) The section of a cone formed by a plane passing through it at right angles to its axis is a circle. If the plane cuts the cone in a direction parallel to its surface, the conic section so formed is a parabola; but any section formed by the passage of a plane through the cone at any angle to its axis between a right angle and the angle at which the surface of the cone is inclined to the base, is an ellipse.

ELM. (*See* ULMUS.)

ELMO'S FIRE, SAINT, *el'-moze*, a luminous appearance or fiery meteor frequently seen playing about the masts and rigging of vessels at sea, during dark stormy nights. The phenomenon is due to atmospheric electricity. The phenomenon gave rise to the Greek myth of Castor and Pollux. It is a common superstition now among sailors that the appearance of such lights at the masthead are a presage of safety in a storm.

ELONGATION, *e-lon-gai'-shun* (from low Lat., *elongo*, I lengthen). In Astronomy, this name is sometimes applied to the angular distance between the sun and any other heavenly body, viewed from the earth's surface.

EMBERIZA, *em-ber-i'-za*. (*See* BUNTING.)

EMBLICA, *em'-bli-ka*, a genus of plants of the natural order *Euphorbiaceæ*, having a fleshy fruit. An Indian species, *E. officinalis*, or, more commonly, *Emblic Myrobalans*, is used in India as a febrifuge for tanning leather and making ink.

EMBROCATION, *em-bro-kai'-shun* (Gr., *embroche*, a moistening), a term originally applied to those external applications used for softening or dissipating swellings. The word has, however, extended beyond its primary meaning, and is applied to oleaginous and spirituous compounds which incite the surface of the skin to increased action, and produce all the effects of counter irritants, or which, by their influence on the extremities of the nerves, assist in resolving spasms, thus acting as antispasmodics.

EMBRYO, *em'-bre-o* (Gr., *embruon*, from *embruo*, I bud forth), is the rudimentary state of any organized body. In Physiology, it is applied to the fœtus *in utero* befor the fifth month of pregnancy, from its growth resembling the budding of a plant. Hence we have *embryology*, a description of the embryo; *embryotomy*, or the extraction of the embryo piecemeal in delivery. In Botany, the embryo is the rudimentary plant existing in the seed. The presence of a true embryo is the essential characteristic of the seed of flowering plants; for a *spore*, as the reproductive body of a flowerless plant is called, has no true embryo, the rudimentary plant being only developed from it after its separation from the parent. Three parts, corresponding to the root, stem, and leaves of the perfect plant, are distinguished in the embryo, and are termed respectively, the *radicle*, the *plumule*, and the *cotyledons*.

EMERALD, *em'-er-ald* (Fr., *émeraude*), one of the precious stones, of a rich deep green colour, occurring in hexagonal prisms in granite, gneiss, and mica rocks. The finest emeralds, however, are found in South America, Bavaria, India, and Siberia. Some specimens from the latter country measure 4½ inches in breadth and 12 in length; but they are worthless as gems, being full of striæ, and not transparent. Emerald consists of silica, alumina, glucina and a little peroxide of iron, lime and oxide of chromium. It is distinguished from beryl by its more brilliant colour, being coloured with oxide of iron instead of oxide of chromium.

EMERSION, *e-mer'-shun* (Lat., *e* from, and *mergere*, to plunge), the term applied to the reappearance of a heavenly body from behind another, after the former has been hidden from view by the passage of the latter across its disc, as in an eclipse.

EMERY, *em'-e-re* (from Cape Emeri, in the island of Naxos), a variety of corundum, consisting mainly of alumina, combined with a small quantity of silica, peroxide of iron, and a little water. Emery occurs in Spain, Asia Minor, in the Greek islands, and in the island whence it takes its name. Ground to powder of different degrees of fineness, it is much used in the arts as a polishing powder, frequently employed attached to cloth or paper.

EMETICS, *e-met'-iks* (Gr., *emetika*), those medicines which influence the stomach in a peculiar manner, so as to invert its action and produce vomiting. This effect is caused not by the quantity of the matter introduced, but by the nature of the emetic itself. Emetics are administered in many cases of illness. They are useful when it is found necessary to relieve the stomach of some hurtful or indigestible substance. Lives that have been endangered either by poisons or excess of food have frequently been saved by means of emetics. In cases of fever, emetics are used: it is supposed that the copious secretion which they produce from the glands of the stomach and intestines has a direct curative action. In all cases of fever, emetics should be administered at as early a stage of the disease as possible. They invariably render the disease milder, and may be advantageously repeated even at a more advanced stage, as they induce sleep and a moist state of the skin. The emetics generally used consist of preparations of antimony, zinc, and copper. Squills, lobelia, ipecacuanha, and other substances, are also employed. Mustard and water diluted is one of the mildest and most generally used emetics. Emetics should never be administered to a patient who is disposed to apoplexy, or a tendency of blood to the head, or where the patient is liable to hemorrhage from any organ, or is subject to hernia. During pregnancy, also, emetics must be avoided.

EMETINE, *em'-e-tine*, the alkaloid which forms the active principal of ipecacuanha root.

EMEU. (*See* EMU.)

EMOLLIENTS, *e-mol'-yents* (Lat., *mollis*, soft), a term employed to denote those substances which are used externally, in medicine, for the purpose of softening the part of the body to which they are applied. They are mostly used in the form of poultices, fomentations, &c.

EMPEROR MOTH (*Saturnia pavonia minor*), one of the most beautiful of the British species of moths. The expanse of its wings is about three inches. The colour is a greyish brown, tinged with purple; the back part of the wings has a band of pale brown and purple, the last band being much waved. In the centre of each wing is a large spot consisting of a black pupil with a yellow or grey iris, partly surrounded by a light blue crescent. The larva is of a green colour, with a black band on each segment, ornamented with pink tubercles, bearing a whorl of six hairs, diverging like a star. The cocoon of the emperor moth is very curiously constructed, the extremity not being closed, but terminated by a converging circle of stiff hairs, which enables the insect to make its escape, but entirely prevents the entrance of all intruders. This moth is of the same family as the silkworm moth (*Bombycidæ*).

EMPETRACEÆ, *em-pe-trai'-se-e* (Gr., *en*, upon; *petros*, a rock), the Crowberry family, a small natural order of dicotyledonous plants in the sub-class *Monochlamydeæ*. They are small heath-like evergreen shrubs, mostly natives of northern Europe and North America. Their leaves and fruit are generally slightly acid. The berries of *Empetrum nigrum*, the crowberry, are eaten in the very cold parts of Europe, and are also employed in Greenland to prepare a fermented liquor.

EMPHYSEMA, *em-fi-se'-ma*, in Physiology, an unnatural distension of a part with air. In case of wounds near the air-passages of the lungs, the cellular tissue is sometimes inflated; and occasionally arises from the decomposition of fluids in the stomach giving out gases, which distend the textures with which they are in contact.

EMPYEMA, *em-pi-e'-ma*. (*See* PLEURISY.)

EMU, *e'-mu* (*Dromaius Novæ Hollandiæ*, or *Dromaius ater*).—This bird is widely diffused over the southern part of Australia, and is closely allied to the cassowary. When fully grown, it measures seven feet in length. The plumage is, for the most part, a mixture of grey and brown, paler below than above; head covered with feathers, which, together with those about the neck, are of a hairy texture. The long feathers observable in the wings of the cassowary are wanting in the emu; but instead of them it has real wings, though of so small a size as to be useless for flight. The legs are short and stout; there are three toes to each foot, and these are furnished with nearly equal claws. It is very swift, and when attacked kicks, as does the ostrich, but not forwards, as does the latter bird, but more as a cow kicks, sideways or backwards. The nest of the emu is made by scooping a shallow hole in the ground in some scrubby spot; concerning the formation of the nest, however, there are various opinions. Its eggs are dark green, and the number laid varies from seven to thirteen, always an odd number. Emus are monogamous, and the males perform the duties of incubation. The eggs are eagerly sought after by the natives as an article of food, as is also the bird itself for the sake of its flesh, which, particularly that about the hind quarters, is said to be of good flavour. The skin contains a large quantity of oil.

EMU WREN, a passerine bird of Australia (*Stipiturus malacharus*), nearly allied to the wren of Europe and America. The genus includes about a dozen species. The bird is found in marshy districts, where it runs rapidly along the grass, with its six tail feathers erect. The resemblance of these feathers to those of the emu is the origin of the name.

EMYS, *e'-mis*, a genus of marsh tortoises, of considerable size, natives of hot climates. They are particularly abundant in North America, especially the painted tortoise, *Emyspiata* and the alligator tortoise, *Emysaina serpentina*. They feed chiefly on animal food. Some of the smaller European species are kept in ponds, fed on vegetable matter, and fattened for the table.

ENCEPHALARTOS, *en-sef-al-ar'-tos* (Gr., *enkephalos*, that which is in the head; *artos*, bread), a genus of the natural order *Cycadaceæ*, composed of elegant palm-like trees and shrubs, mostly natives of South Africa and Australia. From the stems of various species a kind of sago, called Caffre bread, is obtained.

ENCEPHALOCELE, *en-sef-a-lo-sele'* (Gr., *encephalon*, the brain; *kele*, a tumour), the term applied to a tumour projecting through the skull, at a part where the bones were incomplete in infancy, and consisting of a protrusion of the membranes containing a portion of the brain.

ENCHONDROMA, *en-kon-dro'-ma*, an abnormal growth of the cartilage, generally in connection with the bones.

ENCKÉ'S COMET, *eng'-kes*, a comet of periodic recurrence, to which the attention of astronomers was first especially directed when it was discovered by M. Pons at Marseilles, November 26, 1818. The similarity of its elements to those of comets which had been observed in 1786, 1795, and 1805, led M. Encké to calculate its orbit. The comet reappeared in 1882, and on comparing its elements, and the time of revolution, with those of the comets of the years above mentioned, it was found that they were only successive apparitions of the same comet, and that it regularly appeared at its perihelion at intervals of rather more than 1,211 days. It was also found that its period of revolution was gradually growing shorter, at the rate of nearly three hours per revolution, which caused M. Encké to imagine that it was occasioned by some very slight resisting medium spreading throughout the whole of our solar system. It was named after M. Encké, instead of M. Pons, its discoverer, on account of the success of the former in determining its orbit and period of revolution, and predicting its reappearance in 1825.

ENCRINITE, *en'-krin-ite* (Gr., *en*, and *krinon*, a lily), in Geology, any fossil crinoid, or lily-like echinoderm. (*See* CRINOIDEA and ECHINODERMATA.) The encrinites, which form a most important class of fossils, are characterised by their long many-jointed stalks, surmounted by flower-shaped bodies, which were furnished with numerous finger-like rays, capable of closing and expanding. Their internal calcareous skeletons in scattered joints and fragments are so abundant in some carboniferous limestones as to compose the greater portion of the mass; hence the term *encrinal* or *encrinital limestone*. The minuter joints of the fingers and rays are usually termed *entrochi*, or wheelstones, and the limestones in which they abound, *entrochal limestone*. Geologically the encrinites range from the Silurian up to the present epoch. They occur most abundantly in palæozoic and mesozoic strata, rarely in cainozoic, and are now only represented by the comatula or feather-star, and the all but extinct pentacrinus of the West Indies. Like the corals, their function seems to have been, to a great extent, the secretion of lime from the ocean—whole strata of limestone, silurian and carboniferous, being almost entirely made up of their remains.

ENDEMIC, *en-dem'-ik* (Gr., *endemikos*, from *en*, among, and *demos*, the people), a term employed to designate diseases peculiar to a certain class of persons, or to a particular district. Thus ague is an endemic disease in low marshy countries; the goitre in the Alps. They differ from epidemic diseases, which, without reference to locality or class, attack many persons at the same time in the same place, and are contagious: as influenza, scarlet fever, &c.

ENDERMIC, *en-der'-mik*, a method of making the skin the medium for the reception of medicines. (*See* HYPODERMIC.)

ENDIVE. (*See* CICHORIUM.)

ENDOCARDITES, *en-do-kar-di'-tes*. (*See* HEART, DISEASE OF THE.)

ENDOCARP, *en'-do-karp* (Gr., *endon*, within; *karpos*, a fruit), the inner layer of the pericarp of a fruit. In certain fruits it is remarkably hard, and is termed the *stone* or *putamen*. (*See* FRUIT.)

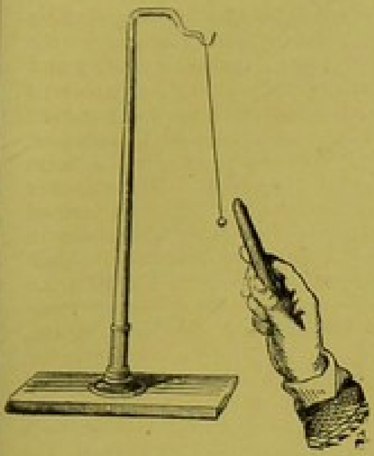
ENDOGENOUS PLANTS, OR ENDOGENS, *en-doj'-e-nus* (Gr., *endon*, within; *ginomai*, I am formed), plants having stems which increase by the addition of new matter within. (*See* MONOCOTYLEDONES.)

ENDOSMOSE, *en-dos'-mose* (Gr., *endon*, within; *osmose*, impulsion), a term originally applied by Dutrochet to the transfusion of gaseous bodies or liquids through membranous substances either of an animal or vegetable origin. (*See* OSMOSE.)

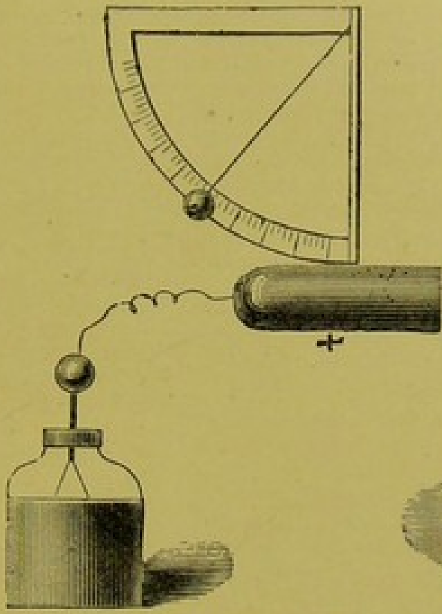
ENDYMION, *en-dim'-e-on*, the Blue-bell, a genus of plants of the natural order *Liliaceæ*. *E. nutans* is the species which adorns the woods and thickets of this country. Its flowers are usually blue, rarely white.

ENERGY, *en'-er-je* (Gr., *en*, within, and *ergon*, work), the inherent power to perform work. Energy is either visible or molecular, and both kinds are divided into *kinetic*, the actual amount of work a moving body is capable of doing at any instant during its motion; and *potential*, or derived from advantage of position.

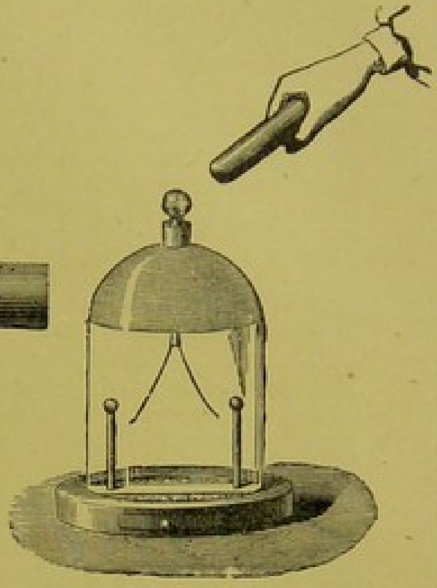
ENTADA, *en-ta'-da*, a genus of climbing shrubs, of the natural order *Leguminosæ*, and sub-order *Mimoseæ*. The seeds lie embedded in a glutinous substance, in pods of a great size,



AN ELECTRIC PENDULUM.



PITH-BALL ELECTROMETER.



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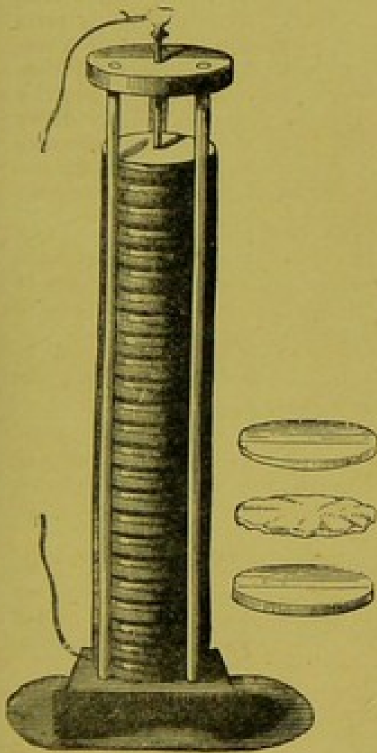
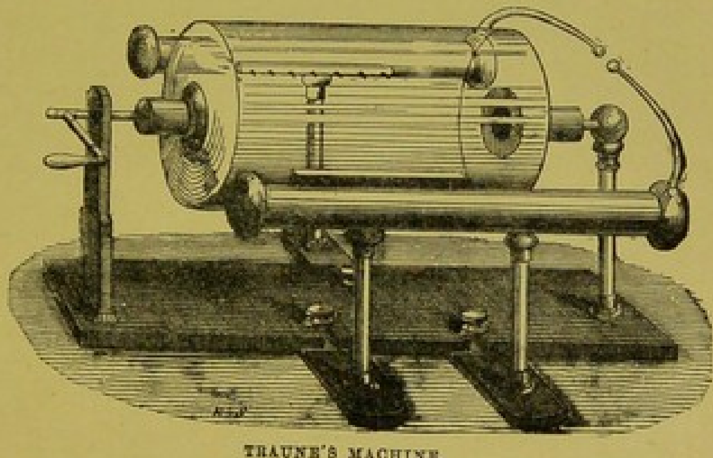
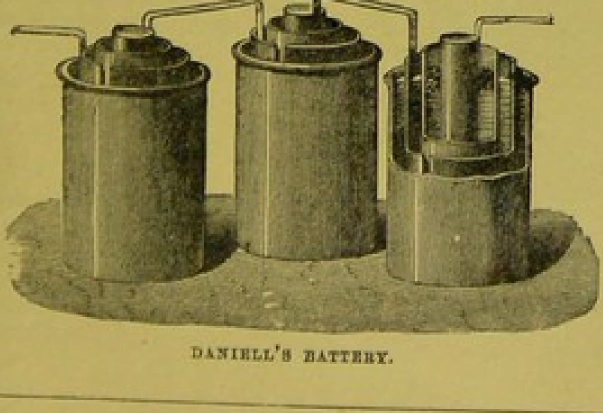


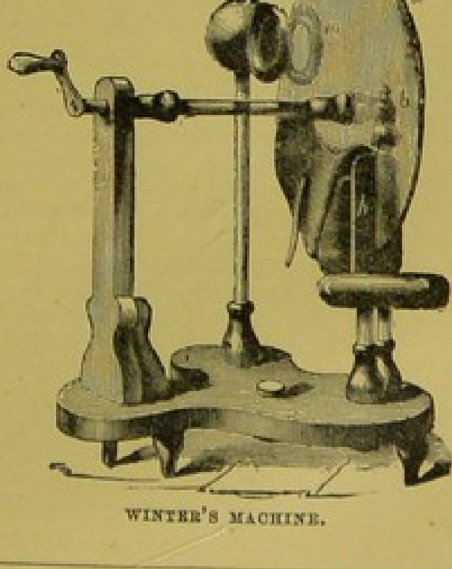
VOLTA'S PILE.



TRAUNE'S MACHINE.



DANIELL'S BATTERY.



WINTER'S MACHINE.

sometimes five feet long and six inches broad. The seeds, of a brown colour, are so large that in Ceylon they are hollowed out and used as boxes. The seeds of an East Indian species (*E. Pursætha*) are saponaceous.

ENTELLUS MONKEY, OR HONUMAN, *en-tel'-lus ho-noom'-an*, a native of the East Indies, with a bluish face surrounded with hair of a light yellow colour, presenting a remarkable appearance resembling the light, bushy, hair and whiskers of a human being. The limbs are long and powerful, and the tail is long, but not prehensile. It is the sacred monkey of the Hindoos, and lives in the villages, and so great is the reverence that the Hindoo laws inflict a greater punishment for killing one of these monkeys than for killing a man.

ENTERITIS, *en-te-ri'-tis* (Gr., *enteron*, the intestines), an acute inflammation of the peritoneal or external coat of the intestines. It is characterised by pain in the bowels (increased on pressure), vomiting, constipation, fever, and great prostration of strength. The brain is generally unaffected, and the intellect remains clear; but sometimes delirium occurs late in the disease. Enteritis may arise from various causes, particularly from cold and wet, more especially applied to the feet or legs, or cold drinks when the body has been previously overheated. Hardened fæcal matters, arising from indigestible substances taken into the stomach, may also produce this disease. Strangulated hernia, or the involution of one fold of the intestine within another, may induce this disease, by causing a complete obstruction to the passage of the contents of the bowels. Various diseases bear a considerable resemblance to enteritis; but that which most closely resembles it is colic, which, indeed, often passes into enteritis. Colic, however, is distinguished from enteritis by the absence of fever, the difference in the state of the pulse, the pain occurring more in paroxysms, and by being usually mitigated by pressure; whereas, in enteritis, it is increased. The ordinary remedies employed in inflammatiom must be resorted to in this disease. Horses and cattle are subject to similar attacks, arising generally from improper feeding, wet pastures, or over driving.

ENTOMOLOGY, *en-to-mol'-o-je* (Gr., *entomon* an insect; *logos*, a discourse), that branch of science which treats of the habits, properties, and organization of insects. The name insect implies an animal insected or divided into segments. This term is applicable to the principal part of the articulate sub-kingdom, and was formerly applied to it; at present the word insect is only used in reference to those articulated animals which are distinguished by antennæ and breathing organs composed of ramified tracheæ, with or without air-sacs. Entomology was not studied as an absolute science till the 17th century, when progress began to be made. The chief naturalists of that period were Goedart, Swammerdam, Malpighi, Leeuwenhoeck, and Ray. The science, however, was very backward, as Ray estimated the whole number of insect species in the world at 10,000. At the present day, it has been ascertained that a larger number than this exists in this country alone. During the 18th century, the great Swedish naturalist, Linnæus, gave his attention to the study of entomology, and his classification, as far as the orders are concerned, has served as the basis of all that have been since promulgated. It is founded on the presence or absence of the wings, their number, consistence, surface, position in repose, and also on the presence or absence of a sting. By this classification, insects were at first divided into seven classes; but additions and alterations have been made since that time. Eleven different orders of insects are generally enumerated. 1, Coleoptera; 2, Orthoptera; 3, Hemiptera; 4, Newroptera; 5, Hymenoptera; 6, Lepidoptera; 7, Shepsitera; 8, Diptera; 9, Suctoria; 10, Thysanoura; 11, Parasita. (*See* various headings.) The Entomological Society of London was instituted in 1833.

ENTOMOSTRACA, *en-to-mos-tra'-ka* (Gr., shells of insects), a term frequently applied to the second of the two great divisions of crustacea. They are of small size, some very minute, and exist in great numbers in stagnant, or nearly stagnant, fresh water, and in sea water. They differ very much in form, some having a large number of organs of locomotion, and some have mouths fitted for mastication, and some for suction. The name has been given because most of the species have shells of one or two pieces, very thin, and of a horny consistence. Many fossil species are met with, especially in the Silurian trilobite, and the old red sandstone.

ENTOPHYTES, *en'-to-fites* (Gr., *entos*, within, *phyton*, a plant), parasitic plants growing on living animals, including all those which have their seat on animal living tissues. Some are *algæ* and some *fungi*, and they occur both in man and in the lower animals, more being peculiar to fishes than to any other class of animals.

ENTOZOA, *en-to-zo'-a* (Gr., *entos*, within; *zoon*, an animal), a term applied to those animals which live within others. They are of low organization, and generally vermiform in structure. In most cases the blood is colourless, and circulates, in the higher organized species, in a closed system of vessels. They have no respiratory organs, no articulated members for locomotion, and no organs of sense. In the higher organized entozoa, a filamentary nervous system has been recognised. Several species of entozoa infest the human body. (*See* INTESTINAL WORMS.) Some of the entozoa only have a parasitic existence during part of the life, the larvæ developing in the intestines, and then, having been discharged, undergo further changes externally.

EOCENE, *e'-o-sene* (Gr., *eos*, the dawn; *kainos*, recent), in Geology, a term designating the lower tertiary strata, from the idea that the very small per centage of still existing species among the fossils of these strata indicates what may be regarded as the *dawn* or commencement of the present condition of creation. (*See* TERTIARY SYSTEM.)

EOZOON CANADENSE, *e-o-zo'-on kan'-a-dense*, a species of foraminifera found in the Laurentian limestone, near Montreal, in 1858, and supposed to be the earliest known form of life.

EPACRIDACEÆ, *ep-a-krid-ai'-se-e* (Gr., *epi*, upon; *akros*, the top), the Epacris family, a natural order of dicotyledonous plants in the subclass *Corolliflorœ*, having a considerable resemblance to the *Ericeæ*, or Heath family. The species are shrubs or small trees, natives of Australia, the Indian archipelago, and the South-Sea Islands, where they are very numerous. About 400 species are known. They are of little importance, except for the beauty of their flowers, on which account they are much cultivated.

EPACT, *e'-pakt* (Gr., *epaktos*, additional), the excess of the solar month above the lunar month, amounting to 1 day, 11 hours, 15 minutes, 57 seconds; and also the excess of the solar year above the lunar year, nearly 11 days. (*See* GOLDEN NUMBER.)

EPEIRA, *e-pe-i'-ra*, a genus of spiders, which construct webs with regular meshes, formed by concentric circles and straight radii. They are well known in gardens, and are among the largest British species; but attain the greatest size and beauty of colours in tropical climates, where there webs are of great strength.

EPHEMERA, *e-fem'-e-ra* (Gr., *epi*, on; *emera*, a day), a genus of neuropterous insects, forming the family *Ephemeridæ*. They have long, soft, tapering bodies, terminating in two or three long setæ. Their wings are placed nearly, or quite, perpendicularly; their antennæ are three-pointed, and very small. In the larva state they live in wet places, or under water, and enjoy an existence of two or three years; but when they attain their final stage of metamorphosis and perfect form, they are among the most fleeting of living creatures, existing often only a few hours, and propagating their species before they die. In this state they sometimes appear suddenly in myriads during fine summer evenings by the water-side, when they may be seen flitting about, and balancing themselves in the air, in the manner of gadflies. They are known also as day-flies and May-flies.

EPICALYX, *ep'-e-kai-liks*, the term applied by many botanists to a circle of bracts appearing immediately below the calyx or outer covering of the flower. It is seen in the mallow tribe, and in many plants of the pink and rose tribes.

EPICARP, *ep'-e-karp* (Gr., *epi*, upon; *karpos*, fruit), the external layer or region of the pericarp or shell of a fruit. (*See* FRUIT.)

EPICYCLE, *ep-i-si'-kl*, the term applied by the ancient astronomers to the supposed movements of the planets round centres, which were describing a large circle round the earth, which was supposed to be the great centre of the planetary system. These imaginary smaller circles were imagined in order to reconcile the different periods of the planets' rotation with the theory of uniform velocity of the heavenly bodies.

EPICYCLOID, *ep-i-si'-kloid*, a peculiar curve, described by every point in the plane of a circle moving in the convex circumference of another circle. The epicycloid has properties useful in the mechanical arts; for instance, the teeth of wheels must have an epicycloidal form in order to secure uniformity of movement.

EPIDEMIC, *ep-e-dem'-ik* (Gr., from *epi*, upon, and *demos*, the people), is a general term applied to diseases which prevail among a large portion of the people of a country or place for a certain time, and then gradually disappear. The most generally assigned causes are a peculiar state of the atmosphere or climate, the seasons, &c. Defective ventilation or drainage, and unwholesome food or drink, are also among the causes that induce epidemics. Most epidemic diseases are likewise contagious, and thus, when once induced, spread with great rapidity. There are epidemic mental diseases, such as the dancing madness, convulsions, and panic, which spread from one person to another, and may involve whole nations.

EPIDERMAL APPENDAGES, *ep-e-der'-mal ap-pen'-daj-es* (Gr., *epidermis*, the cuticle; Lat., *appendo*, I hang or attach to), the general term for certain structures, consisting of cells, variously combined, found upon the surface of the epidermis of plants, or in the sub-epidermal tissue. They may be divided into *hairs* and *glands*. The former are thread-like elongations, externally, of the epidermal cells, covered by cuticle. When a hair is formed of a single cell, it is said to be *simple;* and when composed of several cells, *compound*. Hairs occur upon various parts of plants, and, according to their abundance and nature, give varying appearances to them.

EPIDERMAL TISSUE, the term applied to the external layer of cells in flowering and the higher flowerless plants. This layer may commonly be readily separated as a distinct membrane or skin, as its component cells differ in shape and in the nature of their contents from those cells placed beneath them. This tissue consists of two parts—namely, of an inner portion, usually called the *epidermis*, and of an outer thin pellicle, to which the name *cuticle* is given; but Carpenter, and some other authors, make use of these terms in precisely the reverse sense, calling the external pellicle the epidermis. The *stomata*, or *stomates*, are orifices situated between some of the epidermal cells leading into the intercellular cavities beneath, so as to allow a free communication between the internal tissues and the external air. They are commonly called *breathing-pores*. They vary in form and position in different plants and different parts of the same plant; but they are always the same in any particular part of a plant. The most common form is oval, but they are sometimes seen round or square. We give the numbers counted in a square inch upon the upper and under surfaces of the leaves of a few plants, to show the extent of this variation:—Mistletoe, upper surface 200, under surface 200; pæony, upper surface *none*, lower surface 13,790; house-leek, upper surface 10,710, lower surface 6,000; lilac, upper surface *none*, lower surface 160,000. Stomata exists more or less upon all flowering plants, but are absent from the lower orders of flowerless plants. On floating leaves they are only found on the upper surface.

EPIDERMIS. (*See* SKIN.)

EPIDOTE, *ep'-i-dote*, a mineral composed of silica and alumina, with lime, and peroxide of iron or manganese, and nearly allied to garnet. The colour is green, yellow, or grey; less frequently, red or black.

EPIGASTRIUM, *ep-i-gas'-tri-um* (Greek, *epi*, over; *gaster*, the stomach), is that part of the abdomen which extends from the sternum to the navel, and is commonly known as the pit of the stomach.

EPIGENESIS, *ep-i-gen'-e-sis* (Greek, *epi*, and *genesis*, a formation), a term applied in physiology to the theory which supposes new formations in organized beings to spring from superadded centres of vital activity as opposed to the theory which supposes that the new structure is formed by a development or modification of the old.

EPIGLOTTIS, *ep-e-glot'-tis* (Gr., *epi*, upon, and *glotta*, the tongue), the cartilage at the root of the tongue that falls upon the glottis, or superior opening of the larynx. It is somewhat oval, rather convex above and concave below, and covered by mucous membrane. It adheres inferiorly to the interior part of the thyroid cartilage by a strong elastic membrane. Its apex is loose, and always elevated upwards by its own elasticity. When the back of the tongue is drawn backwards in swallowing, the epiglottis is put over the aperture of the larynx, and thus shuts up the passage from the mouth into the larynx.

EPIGYNOUS, *e-pij'-e-nus* (Gr., *epi*, upon; *gune*, female), a term applied to the stamens and corolla of a plant when they appear to arise from the summit of the ovary, in consequence of the adherence of the calyx to that organ. Examples may be seen in the campanula, carrot, and ivy.

EPILEPSY, *ep'-e-lep-se* (Gr., *epilepsis*, from *epi*, and *lambano*, I seize), is a form of disease which receives its name from the suddenness of its attack. It is also called the "falling sickness," from the patient, if standing, suddenly falling to the ground. By the ancients it was called the sacred disease, from being supposed to be due to the influence of the gods or evil spirits. The attack is usually sudden, without any warning. The patient may be in his ordinary health, engaged, perhaps, in his usual occupation, when all at once he utters a piercing scream, and falls to the ground. Immediately thereafter the face becomes violently distorted, the head is usually drawn to one side, the eyes are set and staring, or roll wildly about, the colour of the skin becomes dark and livid, and the veins swollen and turgid; there is frothing at the mouth; the muscles of the lower jaw act violently, producing gnashing of teeth, and frequently the tongue is thereby grievously injured; the arms are sometimes thrown violently about, and the lower limbs may be agitated in a similar manner, while the fingers with greater power clutch at whatever comes in their way. The breathing is at first heavy and difficult, but afterwards it becomes short, quick, and stertorious, and is often accompanied with sighing and moaning. One side of the body is commonly more agitated than another. After a longer or shorter period, the convulsive movements gradually diminish, and the patient seems to recover a faint glimmering of consciousness; but the look which he casts around is stupid and heavy, and he goes off into a lethargic sleep, from which he does not awake for some hours. Commonly there is no consciousness of anything that occurred during the paroxysm. On coming out of the fit, there is generally headache,, and always languor, and it may be days before he fully recovers from the attack. The duration of the paroxysm is usually from five to ten minutes; but sometimes several attacks follow each other, and it may be protracted for several hours. This is a severe form of epilepsy; but frequently it is less severe, consisting merely of loss of consciousness, slight rigidity, and the convulsion of a few muscles, and lasting only for a minute or two. Occasionally death takes place during the paroxysm; but generally it is attended with little danger, unless the patient may injure himself by falling in some dangerous position. During the attack, the principal thing is to see that the patient do not injure himself. The dress should be loosened about the neck and chest; the head, if possible, a little raised, and a free circulation of air maintained. The return of the fit is exceedingly various in different individuals; several years, in some cases, intervening between the attacks, while in others they may occur every month, week, or day. When neglected, they usually become more and more severe, or recur at shorter intervals. Repeated attacks of this disease, in general, soon produce a marked change in the mental and physical character of the individual. There is a gradual diminution of the active powers, purpose becomes irresolute, the spirits are depressed, and the memory fails; the features become coarse, heavy, and inexpressive, and the look vacant. The most frequent perhaps, of the consequences of confirmed epilepsy is insanity, either in the form of acute mania or monomania following the attacks, or of gradual imbecility, without any acute seizure. Though the fit, as we have said, usually comes on suddenly, yet there is sometimes distinct warning of its approach. These vary in different individuals, and may be lowness of spirits, irritability, dizziness, noises in the ear, floating specks before the eyes. There is, however, a particular sensation which is said to be felt by some immediately before the attack, and which is known as the *aura epileptica*. It is variously described as resembling a current of air, a stream of water, or a slight convulsive tremor, commencing in one of the limbs, and proceeding upwards to the head, when the patient is deprived of all consciousness. Epilepsy is commonly divided into idiopathic, when it is a primary disease, depending on some affection of the brain, and sympathetic, when produced by an affection in some other part of the body—as the stomach, bowels, liver, circulating system, &c. Among the causes which give rise to epilepsy are external injuries done to the brain by blows, wounds, fractures, and the like, or internal injuries by water in the brain, tumours, concretions, and polypi. Violent affections of the nervous system, sudden frights, strong mental emotions, acute pains in any part, worms in the stomach or intestines, teething, suppression of accustomed evacuations, &c., are causes which also produce epilepsy. Sometimes it is hereditary, at other times it arises from a predisposition, occasioned either by plethora, or a state of debility. When it arises from hereditary predisposition, or comes on after the age of puberty, or when the attacks are frequent and of long duration, it is usually difficult to effect a cure; but occurring in early life, and occasioned by worms or any other accidental cause, it may, in general be remedied with ease. Where the disease can be traced to any special exciting cause—as injuries of the head, worms, teething, &c., the treatment should be first directed to its removal. Where, as is often the case, a plethoric state appears to occasion the disease, the patient is to be restricted to a low diet, frequent purgatives are to be exhibited, and everything avoided that may determine the blood to the head; and to counteract such a tendency, occasional cupping, blisters, issues, &c., may be useful. If, on the contrary, there are marks of inanition and debility, a generous diet, with tonic medicines and other means of strengthening the system, will be proper. In this disease great care is necessary in the matter of diet, and moderation in quantity and simplicity in character are material points.

EPILOBIUM, *ep-i-lo'-bi-um*, a genus of plants of the natural order *Onagraceæ;* herbaceous perennials, natives of temperate and cold climates. Some of them bear beautiful flowers. One species, *E. angustifolium*, is sometimes known as the French willow. In Kamschatka, the pith yields a quantity of sugar, which is used for making a kind of ale, and also vinegar.

EPIPETALOUS, *ep-e-pet'-a-lus* (Gr., *epi*, upon; *petalon*, a petal), a term applied to the stamens of a flower when they are attached to the corolla, as in the primrose.

EPIPHEGUS, *ep-e-fe'-gus* (Gr., *epi*, upon; *phago*, I devour), a genus of plants belonging to the natural order *Orobanchaceæ*. The root of *E. Virginiana* is called cancer-root, from having been formerly used as an application to cancers.

EPIPHYTES. (*See* AIR-PLANTS.)

EPITHELIUM, *ep-e-the'-le-um*, the cell tissue which invests the outer surface and the mucous and other membranes of the human body.

EPIZOA, *ep-e-zo'-a* (Gr., *epi*, on; *zoon*, an animal), a term applied to those parasitic animals which live upon the bodies of other animals. They may be divided into two classes—those which live on the surface of the skin, and those which live in the skin. In the first class may be mentioned fleas, lice, bugs, ticks, &c.; and in the second, the itch-insect or *sarcoptes*, the pimple-mite, together with other species of the Acaridæ.

EPIZÖOTICS, *ep-e-zo-ot'-ikz* (Greek, *epi*, upon, and *zoon*, an animal), diseases of animals which prevail at the same time over considerable tracts of country and partake of a common character.

EPOCH, *e'-pok* (Lat., *epocha*, point of time). —In Astronomy, the longitude or right ascension of a planet, at any particular moment of time, is simply called the epoch of that planet, for the sake of brevity. In order to determine the future position of a planet in the heavens at any particular period, it is necessary to reckon from its epoch, or known longitude at a certain point of past time.

EQUATION, *e-kwai'-shun* (Lat., *æquare*, to make even or equal), the rate of motion of the heavenly bodies revolving in elliptic orbits is variable, and they are, from different causes, sometimes in advance of, and sometimes behind, the position in which they would be if they travelled at a uniform rate of motion. In calculating the position of a heavenly body from any epoch, a small amount, by way of correction, must consequently be added to or taken from its longitude at the time required, as it would be if it moved at a uniform rate; and this correction is termed an equation. There are various equations required in astronomical calculations of the longitude of heavenly bodies at given periods, arising from the attraction exercised on the planets by the sun, and that which they exercise on one another and their satellites. The moon's annual equation, the equation of time, and the equation of precession of the equinoxes, will be noticed elsewhere. (*See* MOON, SUN, PRECESSION.)

Equation of Light.—The allowance to be made for the time occupied by the light in traversing a variable space. It is to be considered in conjunction with aberration. (*See* ABERRATION.)

Equation of the Centre.—The orbit of the earth being slightly elliptical and the motion quicker at perihelion (when nearest the sun) than at aphelion (when furthest away), the "mean" longitude and the true longitude differ in a slight degree, and the quantity by which they differ is called the equation of the centre.

Equation of Time.—The want of uniformity in the sun's apparent motion, and the obliquity of the ecliptic to the equinoctial, produce an inequality in the time of the sun's appearance on the meridian, and the correction of this is the equation of time. The mean noon is sometimes 16½ minutes before the apparent noon, and sometimes 14½ minutes behind. Four times in the year, about the 15th of April, the 15th of June, the 31st of August, and the 24th of December, the mean and the apparent motions agree.

EQUATIONS, a term applied in Algebra to those propositions which assert the *equality* of two quantities. The sign $=$ placed between the two quantities signifies that they are equal. Thus $5x+10=25$, is an equation expressing the equality of the quantities $5x+10$ and 25. A simple equation is that which contains only the first *power* of the unknown quantity or quantities. Pure equations of the higher degrees are those which contain the square or any higher power of the unknown quantity, and are divided in two classes—*pure* and *affected*. A pure equation is that in which only one power of the unknown quantity is involved, and an affected equation is that in which different powers of the unknown quantity are involved. Thus, $ax^2=b$ is a pure equation, and $ax^2+bx=c$ is an affected equation. An affected quadratic equation is that which contains the square of the unknown quantity and also the unknown quantity itself.

EQUATOR, *e-kwai'-tor* (Lat., *æquus*, equal), the name given to the imaginary great circles that surround the heavens and the earth midway between the poles, so that every point in them is equidistant from each polar point. The plane of the terrestrial and celestial equator is at right angles to the axis of either sphere. The equator is so called because day and night are equal when the sun crosses it at the vernal and autumnal equinoxes in his passage along the ecliptic.

EQUIDÆ, *e-kwi'-de*, a family of mammalia, of the order *Pachydermata*, containing only a small number of species, comprising the horse and its allies. The name *Solid ungula* (solid hoofed) is sometimes applied. Their most striking character consists in the structure of the feet, which are composed of but a single finger or toe terminating each extremity, and encased in a horny sheath or shoe. Besides this well-developed toe, however, the Equidæ possess on each side of the metacarpus and metatarsus two small rudimentary processes, which represent two lateral toes. (*See* HORSE.)

EQUILATERAL, *e-kwe-lat'-e-ral* (Lat., *æquus*, equal; *lateralis*, side), having all the sides equal; as an equilateral triangle. All the regular polygons are equilateral.

EQUILIBRIUM, *e-kwe-lib'-re-um* (Lat., *æquus*, equal; *libra*, balance), a state of rest produced by the mutual counteraction of several forces. (*See* MECHANICS, STATICS.)

EQUINOCTIAL, *e-kwe-nok'-shal* (Lat., *æquus*, equal; *nox*, night).—The celestial equator is sometimes called by this name, because day and night are of equal length all over the world when the sun crosses the equator.

EQUINOXES, *ek'-we-noks-ez*, the points in which the great circles known as the ecliptic and equator cut each other. They are distinguished as the vernal and autumnal equinox. The sun is at the former on the 21st of March, when he enters the first point of Aries; and at the latter on the 22nd of September, when he enters the first point of Libra. In the southern hemisphere, the names of the equinoxes are transposed; the vernal equinox to those who are north of the equator becoming the autumnal equinox to those in countries lying to the south of it; and the autumnal, the vernal equinox.

EQUISETACEÆ, *ek-we-se-tai'-se-e* (Lat., *equus*, a horse; *seta*, a hair, or bristle), the Horsetail family, a natural order of *Acotyledones*, sub-class *Acrogenæ;* consisting of herbaceous plants, with striated, hollow, jointed, simple or verticillately-branched, aerial, silicious stems, arising from slender creeping rhizomes, or underground stems. The joints are surrounded by membranous toothed sheaths, which are regarded as modified leaves; but, in general, the plants of the order are considered leafless. These plants are found in marshy or watery places in most parts of the world. There is but one genus, *Equisetum*, which includes about ten species, the greater number of which are indigenous. The silex, or flint, contained in the tissue of the rough horsetail, *Equisetum hyemale*, renders it a useful plant. Its stems are largely imported from Holland under the name of Dutch rushes, and employed by cabinetmakers, whitesmiths, and ivory-turners for smoothing the surface of their work.

EQUISETITES, *ek-we-se-ti'-tes* (Lat., *equisetum*, the plant horsetail), the name given to fossil plants which resemble the equisetum of our pools and marshes. They are found in all formations, from the Devonian upwards.

EQUISETUM. (*See* EQUISETACEÆ.)

EQUIVALENTS. (*See* ATOMIC WEIGHTS.)

EQUULEUS, *e-kyu-ul'-e-us* (Lat., the little horse), one of the old Greek constellations named by Ptolemy, and situated between Aquila and Capricornus. Its brightest stars are of the fourth magnitude only. There is another constellation, named by Lacaille *Equuleus pictoris*, the easel, or painter's horse, which is situated near the constellation Argo.

ERBIUM, *er'-be-um*, an exceedingly rare metal, found with yttrium and terbium in gadolinite. The oxide erbia is similar in its characteristics to alumina. It has a dark yellow colour, but forms colourless salts.

EREMACAUSIS, *e-re-ma-kaw'-sis* (Gr., *erema*, slow; *kausis*, burning), a term applied by Liebeg to the slow decay of moist organic bodies by the absorption of oxygen without the production of heat. The slow decay of wood, under the combined influence of air and moisture, is an instance of this action.

ERGOT OF RYE. (*See* SECALE.)

ERICACEÆ, *e-ri-kai'-se-e* (Lat., *erica*, heath), the Heath family, a natural order of dicotyledonous plants in the sub-class *Corolliflore*, consisting of 42 genera and about 850 species. They are very abundant at the Cape of Good Hope, and are more or less generally diffused throughout Europe, North and South America, and Asia; and there are a few species in Australia. Many of the *Ericaceæ*, particularly species of the genera *Erica*, *Rhododendron*, *Kalmia*, and *Azalea*, are largely cultivated in this country on account of the beauty of their flowers. The three latter genera are commonly called American plants by florists; but they are not confined to America, as the name would imply. Medicinally, the plants of this order are chiefly remarkable for astringent properties. Some, however, are narcotic, and a few even poisonous. The fruits of many are edible.

ERIDANUS, *e-rid'-a-nus*, a constellation formed and named by Aratus after the river Eridanus. It stretches along the heavens from Phœnix to Orion, in the shape of a winding river; it has one star of the first magnitude, and many of the third and fourth.

ERIGERON, *e-rij'-e-ron*, a genus of plants of the natural order *Compositæ*, sub-order *Corymbiferæ*, having heads of many florets. A British species, *E. acris*, commonly known as the Flea-bane, is about eighteen inches high.

ERIOCAULACEÆ, *er-e-o-kaw-lai'-se-e* (Gr., *erion*, wool; *kaulon*, a stem), the Eriocaulon, or Pipe-wort family, a natural order of *monocotyledones*, consisting of aquatic or marsh plants, mostly natives of tropical America and the north of Australia. One species is found in Britain—namely, *Eriocaulon septangulare*, the pipe-wort.

ERIODENDRON, *er-e-o-den'-dron* (Gr., *erion*, wool; *dendron*, a tree), a genus of the natural order *Sterculiaceæ*. The most remarkable species is *E. Samauma*, a native of South America. Its trunk frequently overtops all the surrounding trees before it gives off a single branch. The flowers are large and beautiful. The hairy covering of the seeds of various species of this genus forms a kind of vegetable silk much used for stuffing cushions and similar purposes.

ERIOPHORUM, *er-e-of'-o-rum* (Gr., *erion*, wool; *phoreo*, I bear), a genus of the natural order *Cyperaceæ*, or Sedge family, consisting of numerous species, commonly known as cotton-grasses, from their fruits being surrounded by cottony or downy hairs. These hairs are sometimes used for stuffing cushions. The leaves are reputed to possess astringent properties.

ERMINE, *er'-min* (Fr., *hermine*), *Mustela ermina*.—This little digitigrade animal is found generally in temperate Europe, but is common only in the north. It is not generally known that the ermine and the stoat are the same animal: the confusion arises from the change that takes place in the colour of the animal's fur at the different seasons. In the winter it is yellowish-white, the yellow hardly showing about the head, but gradually appearing more and more on the body, and increasing in intensity, so that some are of a pale yellow colour on their hind parts: then it is known as the ermine. About the end of March, however, the upper parts change to reddish-brown of rather a dull tint, the lower parts continuing white: the tail remains black at the tip through all the changes. It is in the extreme northern regions that this change in the animal's colour takes place with greatest distinctness. Like many other species of this genus, the ermine has the faculty of ejecting a fluid of a strong musky odour. Its fur is in great request; at one time it was one of the insignia of royalty, and it is still worn by the judges.

ERNE, a genus of birds (*Haliæëtus*), of the Falcon family, differing from the true eagles in the greater length of the bill, in the toes, and the lower part of the tarsi being destitute of feathers, in feeding on fish and carrion, and in inferior courage. The only British species is sometimes known as the sea-eagle. (*See* EAGLE.) It seldom measures more than 33 inches in total length.

EROSION, *e-ro'-zhun* (Lat., *erosus*, gnawed or worn away), the act of gradually wearing away; the state of being gradually worn away. In Geology, this term is employed to distinguish those features which are the results of the slow destructive action of running water, glaciers, the waves, and other agents; thus, *valleys of erosion* are those valleys which have been gradually cut out of the solid strata. Most of the ravines and glens and river-channels in the British isles are the results of erosion. Just as actual sea-cliffs are proofs of the erosive action now in operation, so in almost all cases, inland cliffs, crags, scars, and precipices, as well as valleys, ravines, gorges, and mountain-passes, are proofs of the erosive action of the sea in times when the land stood at a lower level with respect to it. A still more wonderful example of erosion is frequently afforded in a low and gently undulating district, from which the very mountains themselves, that geologists can prove once covered it, have been removed. (*See* RIVER, GLACIER, ICEBERG.)

ERRATIC-BLOCK GROUP, *er-rat'-ik* (Lat., *erraticus*, wandering), a synonym of the boulder clay, from the large transported blocks of stone which occur in it. The blocks, or boulders, are sometimes briefly designated erratics. (*See* BOULDERS, PLEISTOCENE.)

ERRHINES, *er'-rines* (Gr., *errinon*, from *en*, in; *rin*, the nose), those medicines which are applied to the mucous membrane of the nostrils. The term *sternutatories* is restricted to those which cause sneezing. The aromatic errhines most commonly applied are powdered herbs—as mint, lavender, and rosemary; also tobacco as snuff. Ammonia and its carbonates are much employed. Acrid vegetables and poisons, and preparations of mercury, are applied in rare cases.

ERVUM, *er'-vum* (Lat., *eruo*, I pull up by the roots), the Tare, a genus of the natural order *Leguminosæ*, sub-order *Papilionaceæ*, consisting of herbs with weak and slender stems, small papilionaceous flowers, and pods containing from two to four seeds. The species are common fodder plants in many parts of the world. The seeds of the *E. Lens* are called *lentils*. (*See* LENTILS.)

ERYNGO, *e-rin'-go*, a genus of plants of the natural order *Umbelliferæ*. There are many species, mostly natives of the warmer temperate parts of the world. The Sea Eryngo, or Sea Holly (*E. maritimum*) is frequent on sandy sea shores. The root was formerly used as a tonic; and at Colchester especially was sold in a candied state. An American species, *E. aquaticum*, is known as Rattlesnake Weed, from its supposed value as a remedy for snake-bite.

ERYSIMUM, *e-ris'-i-mum*, a genus of plants of the natural order *Cruciferæ*, tribe *Sisymbrieæ*. The best known species is a branching annual about 18 inches high, with small yellow flowers. It is a native of the north of Europe and North America. It is commonly known as worm-seed, having been used as a remedy for those parasites. It is also known as Treacle-Mustard.

ERYSIPELAS, *er-e-sip'-e-las* (Gr., from *eruo*, I draw; and *pelas*, near or adjoining), is the name given to a peculiar kind of inflammation of the skin, so called from its tendency to spread to adjoining parts. It is known also as St. Anthony's fire or *ignis sacer*, and in common language as the Rose. It most commonly attacks the head and face; but it also sometimes occurs on other parts of the body. The local inflammation is preceded and accompanied with fever, and there are also usually certain premonitory symptoms that precede the outbreak of the disease; the patient feels ill—shivery, feeble, languid, and often drowsy. After these symptoms have continued for some time, a red spot appears on some part of the body, accompanied with a burning heat and tingling. When attacking the face, it usually makes its appearance on the bridge of the nose, and rapidly extends itself to the eyelids, cheeks, and forehead. Sometimes the inflammation and swelling extend to the neck and throat, and may produce suffocation. In very bad cases, delirium and coma come on, and death ensues from effusion on the brain. No remission of the fever takes place on the appearance of the inflammation; but, on the contrary, it generally increases with the progress of the inflammation, and only ceases when it goes away. When the complaint is mild, the inflammation and fever generally cease gradually without any evident crisis. Among frequent causes of this disease, are exposure to a cold and moist atmosphere, sudden changes of temperature, intemperance, and unwholesome articles of food. It is sometimes also induced by wounds or sores, or even a slight puncture or scratch of the skin in persons predisposed to it. It is likewise contagious, and has to be strictly guarded against by means of ventilation and cleanliness in hospitals. Though the proper seat of the inflammation is the skin, it frequently extends to the parts underneath.

ERYTHEMA, *er-e-the'-ma* (Gr., *eruthros*, red), a lesser kind of erysipelas, being characterised in like manner by some degree of redness of the skin and disorder of the constitution, but with little swelling, and little tendency to suppuration or vesication. It is not infectious, and usually arises from some local irritation, or from a disordered state of the digestive organs.

ERYTHRÆA, *er-e-thre'-a*. (*See* CENTAURY.)

ERYTHRINA, *er-ith-ri'-na*. (*See* CORAL TREE.)

ERYTHRONIUM, *er-ith-ro'-ne-um*, a genus of plants of the natural order *Liliaceæ*, with bulbous roots and drooping flowers. The familiar *Dog-tooth Violet* (*E. dens canis*) is a native of the central parts of Europe and the south of Siberia. The bulbs are sometimes used medicinally as emetics and as a cure for worms.

ERYTHROPHLÆUM, *er-ith-rof'-le-um*, a genus of the natural order *Leguminosæ*, sub-order *Mimoseæ*. *E. Guineense* is the sassy-tree of Western Africa, the bark of which, under the name of "ordeal bark," or "doom bark," is used by certain tribes as an ordeal to which persons suspected of witchcraft or secret poisoning are subjected, from the superstition that their innocence or guilt will be indicated by the effects produced by the bark on the system.

ERYTHROXYLACEÆ, *er-e-throks-e-lai'-*

se-e, the Erythroxylon family, a natural order of dicotyledonous plants, in the sub-class *Thalamifloræ*; consisting of but one genus, *Erythroxylon*, which includes seventy-five species, natives of the warmer regions of the globe, and especially abundant in Brazil. This order is closely allied to *Malpighiaceæ*, and in fact scarcely presents characters sufficient to warrant its separation from that order. Some of the plants are tonic, others purgative, and others stimulant and sedative. The wood of *E. hypericifolium*, and the bark of *E. suberosum*, are red, and are used for the preparation of dyes of that colour. The most important species is *E. Coca*, the leaves of which are much used by the Peruvians and other peoples of South America to form a masticatory, which is prepared by adding to them a very small quantity of an alkaline paste, made from the ashes of different plants, or even a little common quick-lime. The Indians of Peru have always ascribed to the coca marvellous virtues, believing that it will lessen the desire and necessity for ordinary food. No Quitchoan Indian would dream of crossing the snow-clad passes without a sufficient store of coca leaves. It is certain that these men, who cross the Andes by almost impassable tracks, heavily laden with baggage, and without any strengthening food but coca, arouse the admiration of every traveller by their wonderful feats of great endurance. The Indians of Peru have a singular habit of measuring distances by so many mouthfuls of coca. To understand this we must remember that the stimulating effect produced by the chewing of a few leaves continues for a definite period, and if the coca globule held in the mouth is not refreshed by the addition of new leaves, its effects pass off, and a reaction of physical weakness sets in. "As a result of the observations made during my journey," says Bastion, "it may be concluded that the excitement begins after the coca has been held in the mouth for about eight to ten minutes, and that if no fresh leaves are added it will last for thirty-five to forty minutes." Its excessive use is stated to be most injurious, producing analogous effects to those occasioned by the immoderate consumption of opium and fermented liquors.

ERYTHROXYLON. (*See* ERYTHROXYLACEÆ.)

ESCALLONIACEÆ, *es-kal-lo-ne-a'-se-e* (in honour of Escallon, a Spanish traveller), the *Escallonia* family, a small natural order, subclass *Calycifloræ*, consisting of evergreen shrubs, with alternate exstipulate leaves and axillary showy flowers. They are chiefly natives of the mountains of South America.

ESCALOP, OR ESCALLOP, *es-kal'-lup* (Du., *schalp*, a shell), a family of bivalve molluscs the shells of which are deeply indented. In the centre of the top of the shell is a trigonal sinus, with a hinge consisting of elastic cartilage.

ESCASS, *es'-kass*, long narrow ridges of carboniferous limestone, accumulated during the Pleistocene period. They are known in Scotland as *kames*, and in Sweden as *äsar*.

ESCHALLOT, *es-shal-lot'* or *shal-lot'* (Fr., *échalote*), *Allium ascalonicum*, a species of small onion or garlic. It is said to have come originally from Palestine.

ESCHAR, *es'-kar* (Gr., *eschara*), the crust of a scar produced by burning substances of a caustic nature which have the power of searing or destroying the flesh. (*See* CAUTERY, CAUSTIC.)

ESCHSCHOLTZIA, *esh-kolt'-zhe-a*, a genus of plants of the natural order *Papaveraceæ*. The calyx separates from the dilated apex of the flower-stalk, being thrown off by the expanding flower. Some of the Californian species have large yellow flowers, and are cultivated in our gardens.

ESENBECKIA, *es-en-bek'-e-a*, a genus of trees of the natural order *Diosmaceæ*. One species, a native of Brazil (*E. febrifuga*), furnishes a bark reported to be of equal medicinal value with Peruvian bark.

ESOCIDÆ, *es-os'-ci-de*, a family of malacopterous fishes, now regarded as including only the pikes. Flying-fishes were until recently considered to belong to this family.

ESOTERIC, *es-o-te'-rik*, a term applied by the Greeks to these doctrines designed only for those who had been initiated in the ancient mysteries, and not to be imparted to others. The teaching considered to be different from the initiated was styled *exoteric*.

ESPARTO, OR SPANISH GRASS, *es-par'-to* (Spanish), a species of grass, the *stipa*, or *Macrochloa tenacissima*, obtained from Africa and Spain. In Spain it is plaited and used in many ways, and a great deal of the cordage employed in the navy of that country is made from it. Within the last few years esparto has been largely imported into this country for making paper. It grows in bunches or tufts from two to four feet in height.

ESQUIMAUX DOG, *es'-kwe-mo.*—This animal is rather larger than the English pointer, but appears less, on account of the shortness of its legs. It has oblique eyes, an elongated muzzle, and a bushy tail, which curls over the body. The colour is generally a deep dun, obscurely barred and patched with darker colour. In the northern parts of America and the neighbouring islands, this animal is the only beast of burden. With a team of dogs harnessed to his sledge, the Esquimaux may scud over the snow at a rate of sixty miles a day, and this for several days in succession.

ETHMOID BONE, *eth'-moid* (Gr., *ethmoides*, from *ethmos*, a sieve, and *eidos*, because it is perforated like a sieve), one of the bones of the head, which is exceedingly light and spongy, consisting of many convoluted plates, which form a network like a honeycomb. It is somewhat cubical in form and is situated between the two orbitary processes of the frontal bone, at the root of the nose. The olfactory nerves shoot down through the numerous small perforations of this bone to the organ of smell.

ETHNOLOGY, *eth-nol'-o-je* (Gr., *ethnos*, nation, and *logos*, discourse), is that science which treats of the varieties of the human race, their history and distribution, their languages, physical and mental characteristics; arranging and classifying them, noting their points of similarity or dissemblance, and having in view the difficult problem of the unity or non-unity of the human race. Ethnology differs from anthropology in that the latter deals with the relations of man to the other members of the animal kingdom, whereas the former regards the differences that exists among the different varieties of the human race. It partakes of history, but, unlike ordinary history, which deals with actions, it treats of the effects of physical agencies upon man—soil, climate, nutrition, and the like; going back to a period long anterior to the existence of written records, and, unlike history, arguing from effects to causes, from the known to the unknown. In this way ethnology is, as Prichard says, the general archæology of the human race. Language, too, forms an important element in the study of ethnology as well as physical geography, which teaches the relations that subsist between the inhabitants of a given area, and its physical configuration, climate, &c. (*See* PHYSICAL GEOGRAPHY.) The ethnologist should thus not only be a naturalist, but should also have a knowledge of archæology, or the study of human monuments and remains; philology, or the science of languages; and physical geography, so far as it relates to the effects of physical influences upon different races. The science of ethnology is of recent origin, and is as yet almost limited to the accumulation and record of observations, which may perhaps, in time, lead to the discovery of the basis of a systematic ethnological philosophy. The evolutionists are busy with theories on the subject, and many are disposed to argue that the human being is a development from inferior organizations; but, if so, there must have been a remarkable cessation of the development process after man had attained his present form. In no other family of animals is there such uniformity of size and structure. The equine, the canine, the feline, or the bovine families—not to refer to innumerable others—all nearly allied by the possession of some common attributes, exhibit an almost infinite variety of detail; but in the human race the variations are almost insignificant. The general organization of man in all countries is absolutely the same, the only difference being in the greater activity of some of the organs induced by civilization or the necessities of existence. Geology has revealed to us the existence in prehistoric times of animals allied to those which now exist, but with great variation in organization, and differing very considerably in size. Among the fossils are the skeletons of creatures far exceeding in size any now living, and, on the other hand, bones of a small animal scarcely larger than a dog of one of the breeds of medium size, which geologists assert was the progenitor of the modern horse. But so far as science has been able to discover, the human being has ever been of the same average dimensions. Individuals of all races vary in height; the average bulk of the inhabitants of tropical climates is generally less than that of the people who dwell in the regions of temperate climate; and stunted men and women occupy the colder parts of the earth; but so it has been apparently in all ages. The skeletons found in old barrows, representatives of the men of the prehistoric period, the bones found imbedded in strata of great antiquity, are of about the same dimensions as those of the men of to-day. No necessity of existence has lengthened the arms or neck, changed toes into thumbs, or added a finger to the hand. The general type of all men in all regions, from the equator to the poles, is that they are two-handed, walk erect, have the power of speech more or less developed, and that between even those of lowest organization and the most intelligent of quadrupeds there is a very marked distinction. Human idiots there are, as there are human monstrosities of form; but they are exceptions which prove the permanence of the typical characteristics. While, however, the general agreement in organization appears to be ineradicable, there are certain external differences, in complexion, hair, facial contour, and other minor matters, which seem to indicate separate groups or families of the human race, and have suggested the theories advocated by some ethnologists of distinct centres of creation, in opposition to the more generally accepted belief in the derivation of all human beings from the same stock. In discussing this question, we may fairly take into consideration that, in the respect of the means by which the human race might have spread over the earth, we are not encountered by the difficulties which present themselves when we are examining the history of the movements of other members of animated nature. The will to travel, inspired by many motives, is added to the power to travel, given by natural adaptability to endure atmospheric and other variations, and by the exercise of the reasoning power; and in cases of accidental drifting to unknown islands or continental coasts, there is a power to make the best of adverse conditions. It is quite possible that the intelligent and active descendants of a small family located in south-western Asia should in the course of thousands of years have made their way east and west, north and south, making at intervals settlements which became centres of new dispersions. From Asia to Western Europe was a comparatively easy journey, allowing many centuries for its accomplishment. Africa could be peopled not only by passing across the neck of land which divides it from Asia, but by settlements on the coast made by adventurous mariners, or by parties drifted to the shores. The straits which separate north-eastern Asia from north-western America could be crossed by canoes, visiting the chain of islands on their way. We know that adventurous Northmen of Europe reached the North American coast from Greenland centuries before Columbus crossed the Atlantic; and the Chinese have traditions of discoveries and settlements on the western coast of North America, nearly as far south as California. The islands of the Pacific offer more difficult, but not insoluble problems. The island groups are so numerous, that it is not beyond the possibility of belief to suppose that, either by intention or accident, the inhabitants of one might reach and settle on another. In the course of this long travel, however, geographical considerations would cause variations of colour, features, and habits, which might appear to indicate separate origins. Long residence in hot climates affects the colour of the skin, and it becomes hereditary. The necessity of constant physical exertion to maintain existence, and the absence of intellectual training, develop the muscles and bony framework, and induce a dwindling of the brain. The facial angle becomes more acute, the jaw-bone more prominent, and the figure more lithe and active. In very hot climates less animal food can be eaten, even by recent settlers, and in the course of ages is dispensed with altogether—sometimes from religious considerations, as among the natives of the Indian peninsula and other parts of Asia—and the resulting difference of physique is very noticeable. Other causes, such as the effects of the chemical constituents of the atmosphere and of water, it may be the effects of terrestrial magnetism, are in continual operation, and the results, aided by hereditary transmission, produce the differences which mark what are popularly called the races of mankind.

Ethnological Classifications.—Peter Camper, a distinguished Dutch anatomist of the last century, was the first who attempted to lay down on scientific principles a method of distinguishing between the different races of mankind, from the form and size of the skull, by what is known as the facial angle. The head being viewed in profile, a line is drawn through the *meatus auditorius* of the ear to the base of the nose, meeting another touching the most prominent part of the centre of the forehead, and falling down to the most advanced portion of the upper jaw. The nearer the angle thus formed approaches a right angle the greater, as a general rule, is the intellectual development of the individual; and this is found to be generally the case, not only as regards man, but also among the lower animals—the smaller the facial angle the lower are they in the scale of intelligence. One great deficiency in this method was its taking into account only one feature of the skull, instead of the general capacity and shape, and, to remedy this, Blumenbach fixed upon a number of characteristic peculiarities; and he suggested the division of mankind into the five following classes:—(1) the Caucasian, (2) Mongolian (3) Ethiopian, (4) American, (5) Malay. Cuvier reduced the five classes of Blumenbach into three—the Caucasian, Mongolian, and Ethiopian, treating the Malay and American as subdivisions of the Mongolian. He referred the original seats of the human race to the mountain-chains—the Caucasians to Mount Caucasus, the Mongolian to the Altai mountains, and the Negro to the chain of the Atlas. Dr. Prichard, who was the first to bring to the study of this subject a large knowledge of languages as well as of physiology, regards the banks of the great rivers, and not the mountains, as the primary seats of the different races. The arrangement which he adopts is—(1) The Syro-Arabian or Semitic race (including the Syrians, Jews, and Arabs). This race is intellectual, energetic, and restless. The second group are the Egyptians or Hamitic race, which he regards as indolent and superstitious, reposing ever in luxurious ease and wealth on their own rich soil. The third group is the Indo-European, Japetic, or Arian race, comprising the Hindoos, Persians, Afghans, Koords, Armenians, and the nations of Europe, with their American colonies. The great central region of High Asia is inhabited by five nomadic races, belonging to the Mongolian division of authors, and characterized by pyramidal heads and broad faces. These are—(1) the Ugrian, in the N.W., from whom the Magyars are believed to have descended, and of which the Finns, Laps, Ostaks of the Obi, and other Siberian tribes, are varieties; (2) the Turkish, with their nomadic tribes, and the Ottoman branch; (3) the Mongolian, including the Calmucks; (4) the Tungusian, in the mountainous region between Lake Baikal and the river Okhotsk; (5) and the Bhotiya race (often termed Tartars), inhabiting a great part of Thibet and the Himalayan chain. Beyond the central region occupied by the five nomadic races are various tribes of people, spread over the lower countries of northern Asia, and over the cold plains which are traversed by the Siberian rivers and border of the Icy Sea. They belong to the same great division of mankind as the Tartars, whom they resemble in some of their leading characteristics, particularly in the form of the skull. Prichard termed them Ichthyophagi or fishing tribes. To the same type of the human species as the nations of High Asia belong the Chinese, Koreans, Japanese, the races of the Indo-Chinese peninsula and the aborigines of India, distinct from the Hindoos (who belong to the Indo-European stock). Prichard believed that in the regions afterwards occupied by the Indo-European and Syro-Arabian races there existed a more ancient stock of inhabitants, also of eastern origin, but who had migrated westward at an earlier date, and to whom he gives the name of Allophylians. These, when displaced by the invaders, took refuge in the mountainous parts; and to them belong the Caucasians, the Iberians of the Pyrenees, the Berbers of the Atlas chain, and the Guanches of the Canary Islands. Of the black races of the interior of Africa, the principal are the Senegambian, including the Mandingoes and the Foolahs. The true negro characters are most strongly marked on that portion of the coast which encircles the projecting region of Western Africa to the inmost angle of the Bight of Benin, the centre of the slave trade. The Hottentots and Bushmen of South Africa in many respects resemble the nomadic Mongolians of Asia; the warlike Caffres are said to combine the prominent forehead and nose of the European, the thick lips of the Negro, and the high cheekbones of the Hottentot. Among the African races is the Abyssinian, a fine dark, but not negro race. The Oceanic races Prichard divides into Malayo-Polynesian, Pelagian Negroes, and the Alfoorians of the New Guinea group of islands (which include the Australians). The American races are distinguished from those of the old world by their moral and social traits and by the structure of their languages. The Mexican tribes, which, according to him, arrived on the central plain of Anahuac, from the north, in the 7th century, found this region inhabited by the nations which have left the splendid ruins of Palenque; among whom were the Othomi, remarkable for their monosyllabic idiom. The Esquimaux and the Athabascas, with a Mongolian cast of countenance, extend across the northern portion of the continent from ocean to ocean; south of these, east of the Mississippi, were the Algonquins and the Iroquois, with their numerous tribes, almost always at war with each other, and the Alleghanian nations toward the south; west of the Mississippi were the Sioux and Pawnees; on the Pacific coast the dark Californians and the tribes of the north-west coast; and in South America the Andean nations, the Brazilio-Guarani, and the Mediterranean or central groups. Dr. Latham, one of the latest writers on the subject, finds only three distinctive groups (each with many sub-divisions), and names them Mongolidæ, Atlantidæ, and Japetidæ. The first inhabit Asia, Polynesia, and America; the second Africa; and the third Europe. A convenient arrangement, now very generally adopted, is one which professes to be only descriptive of what exists, and does not attempt to explain the origin of diversities of human being. This arrangement is into six groups:—Iranians, of western Asia; Turanians, including the Mongolian and Malayan races; Negroes; Hottentots and Bushmen of South Africa; Ocean Negroes, including Papuans or natives of the archipelago of the South Pacific, and Alfourons or natives of some parts of New Guinea and Australia; and Americans, including the Esquimaux.

Unity or Diversity of Origin.—We have referred above to some arguments in favour of the theory of a common origin of the whole human race which claim to be taken into consideration, but it is necessary to explain the views of some eminent investigators, mostly American, who have arrived at conclusions in favour of the theory of various centres of origin. Dr. Morton of Philadelphia, who for many years gave great attention to the subject of comparative craniology, arrived at conclusions "in favour of the doctrine of primeval diversities among men, and an original adaptation of the several races to their varied circumstances of climate and locality, which, while congenial to the one, are destructive to the other." In reply to this theory of creative adaptation, it may be urged that no part of the vast surface of the globe, except the frozen poles, or a very few small volcanic or coral islands, is untrodden by the foot of man. The limit on land of the absolute possibility of sustaining animal life is the only limit to the residence or the wanderings of the human race. Members of any of the races, white or black, Semitic, Mongolian, or Negro, can live together in almost any part of the world. Whether there was one act of creation in south-western Asia, or whether there were many acts of creation taking place in different places and at different times, one fact is not affected: that fact is, that man, wherever originating, possesses faculties which make him very independent of geographical conditions. Mountains or seas cannot shut him in; and familiar as we are with his peculiar powers of body and mind, there is no reason why, in the course of ages, the progeny of a single pair dwelling near the Euphrates, or indeed almost any other spot on the earth's surface, should not spread over the entire habitable surface of the globe. Dr. Morton to the last remained firmly convinced that "our species had its origin, not in one, but in several or in many creations, and that these, diverging from their primitive centres, met and amalgamated in the progress of time, and have thus given rise to these intermediate links of organisation which now connect the extremes together." Other advocates of the theory were Mr. G. R. Gliddon and Dr. Nott; and a supporter of even greater scientific eminence was Professor Agassiz, who, in contributions to "Types of Mankind," an elaborate work, edited by Messrs. Nott and Gliddon (1845), holds "that what are called human races, down to their specialization as nations, are distinct primordial forms of the type of man; believing that the boundaries within which the different natural combinations of animals are known to be circumscribed upon the surface of our earth coincide with the natural range of distinct types of man." He gives a sketch of the natural provinces of the animal kingdom and their relation to the different types of man. He classes them according to the following realms:—1, Arctic, inhabited by Hyperboreans; 2, Asiatic, by Mongols; 3, European, by white men; 4, American, by American Indians; 5, African, by Nubians, Abyssinians, Foolahs, Negroes, Hottentots, and Bosjesmen; 6, East-Indian or Malayan, by Telingans, Malays, and Negrillos; 7, Australian, by Papuans and Australians; and 8, Polynesian, by South-Sea Islanders. In the "Indigenous Races of the Earth" (1857), Messrs. Nott and Gliddon give an ethnographic tableau, in which the races are divided zoologically, according to the eight realms of Agassiz; they are also grouped physiologically (after Desmoulins, Achille Compte, and O. d'Halloy) into sixty-five families—seven belonging to realm 1 of Agassiz, twelve to realm 2, sixteen to realm 3, fourteen to realm 4, eight to realm 5, three to realm 6, two to realm 7, and three to realm 8. The same realms have also their corresponding classes, arranged linguistically, after Alfred Maury, Crawfurd, Logan, &c. (In the full-page illustrations, plates 24 and 25, are depicted individuals of some of the various races.)

ETIOLATION, *e-te-o-lai'-shun* (Gr., *aitho*, I shine).—When all the green colour of a plant is absent, it is described as etiolated. This condition is produced by the want of light.

EUCALYPTUS, *u-ka-lip'-tus* (Gr., *eu*, well; *kalupto*, I cover), a genus of the natural order *Myrtaceæ*, consisting of trees having hard wood, alternate, entire, coriaceous leaves, and yellow flowers, growing in corymbs. They are mostly natives of Australia and Tasmania, but are met with also in the Malayan archipelago. The most important species is *E. resinifera*, the iron-bark, which yields on incision an astringent substance called *Botany Bay kino*. This contains a peculiar substance, to which the name *Eucalyptin* has been given. It has been employed as a remedy in diarrhœa and as a surgical dressing. The leaves of *E. mannifera* and other species spontaneously exude a saccharine substance resembling manna, and hence termed *Australian manna*. It is said to drop from the trees in pieces sometimes as large as an almond. The secretions of the *Eucalypti* are commonly of a gummy nature, and on this account the trees are commonly known in Australia as Gum-trees. The bark of some of them separates in fibrous layers; and this peculiarity has also obtained for them the name of stringy-bark trees. They frequently attain a prodigious height—200 feet or more, the trunks being destitute of branches to a height of from 100 to 200 feet. Recently trees have been seen which far surpass in height the renowned Mammoth trees of California, being 480 feet high.

EUGENIA, *u-je'-ne-a* (in honour of Prince Eugene, of Savoy), a genus of the natural order *Myrtaceæ*, composed of tree and shrubs with opposite entire leaves, axillary white flowers, and black or red berries. *E. pimenta* is the most important species. Its dried unripe fruit constitutes pimento, or Jamaica pepper, or, in more familiar language, allspice. The latter name is given to it because it is thought to have combined the flavours of cinnamon, clove, and nutmeg. It is used as a spice, and in medicine as an aromatic stimulant. Its properties are dependent on the presence of a volatile oil. The rose-apples of the East, which are much esteemed as dessert fruits, are the produce of *E. Malaccensis*, *E. aquea*, *E. Jambos*, and other species of this genus. In Brazil, the fruit of *E. cauliflora*, the *Jabuticaba*, is also much esteemed. The leaves of *E. Ugni* are used in Chili as a substitute for Paraguay tea.

EULOPHIA, *u-lo'-fe-a* (Gr., *eulophos*, a handsome crest), a genus of Orchids. The tubercular roots of *E. vera* and *E. campestris* are much used in India for the preparation of the nutritious substance known by the names of salep, salop, and saloop.

EUONYMUS, *u-on'-e-mus* (Gr., *eu*, well; *onoma*, a name), a genus of the natural order *Celastraceæ*. The species *E. europæus* is the common spindle-tree of our hedges. In France, charcoal prepared from the wood is largely used in the manufacture of gunpowder; while the young shoots, in a charred condition, are employed as rough crayons for sketching. The seeds are stated to be purgative and emetic, and also to be poisonous to sheep. The bark of *E. tingens* can be used as a yellow dye-stuff.

EUPATORIUM, *u-pa-to'-re-um* (derived by Linnæus from Mithridates Eupator, who first used it as a counter-poison), a genus of the natural order *Compositæ*, sub-order *Tubulifloræ*. *E. ayapana* and *perfoliatum* are employed as antidotes to the bite of venomous reptiles. Only one species, the common hemp-agrimony (*E. cannabinum*) is British. It is a perennial plant with a slightly aromatic flavour, growing generally in damp soils. It was formerly used as a purgative and diuretic.

EUPHORBIA, *u-for'-be-a* (named after Euphorbus, physician to Juba, king of Mauritania), the typical genus of the natural order *Euphorbiaceæ*, consisting of about 300 species, many of which have valuable properties. The acrid resin commonly known as gum Euphorbium is the produce of certain undetermined species, the principal of which are probably *E. antiquorum*, *canariensis*, and *officinarum*. It is a dangerous emetic, cathartic, and rubefacient, and produces severe inflammation of the nostrils if those who powder it do not guard themselves from the dust. It is produced from the wounded stems, and collected in leather bags. The juice of the species *E. cereiformis*, *heptagona*, and *virosa*, African plants, furnish the Ethiopians with a mortal poison for their arrows; whilst that of *E. cotinifolia* serves a like purpose for the Brazilian Indians. The species *E. Hibernica* is extensively used by the peasantry of Kerry for the purpose of stupefying fish; and so powerful are its properties said to be, that a small creel or basket filled with the bruised herb suffices to stupefy the fish for several miles down a river. *E. hypericifolia*, a plant of tropical America, is astringent and somewhat narcotic, and is employed in the diarrhœa of children and as a vermifuge; and *E. thymifolia* is employed for a like purpose in India. The root of *E. ipecacuanha* is said to be equal to the true ipecacuanha, and is commonly used in the states of North America. Another species, *E. corollata*, the milk-weed, is also used as an emetic in the

States. The fruits of *E. Lathyris*, or caper-spurge, are sometimes pickled and eaten, instead of ordinary capers; but although the process of pickling appears to destroy in a great measure the acrid purgative properties which the fruits possess in a fresh state, their use is by no means free from danger. A very active cathartic oil may be expressed from the seeds of the caper-spurge. Many species are purgative. *E. Tirucalli*, a native of India, is common in the Madras presidency, and makes an excellent hedge, as no cattle will touch its leaves. The sap of *E. phosphorea* is said to shine with a phosphorescent light in the forests of Brazil on warm nights.

EUPHORBIACEÆ, *u-for-be-ai'-se-e*, in Botany, the Spurge-wort family, a natural order of *Dicotyledones*, in the sub-class *Monochlamydeæ*, consisting of trees, shrubs, and herbaceous plants, generally with an acrid milky juice. There are about 2,500 known species, mostly natives of tropical countries. The few species found in the temperate regions are nearly all herbaceous, but the common Box is shrubby.

EUPIONE, *u'-pe-on-e* (Gr., very fat).—A limpid fluid, first discovered by Reichenbach in wood tar. It is found in the tar produced by the destructive distillation of several vegetable and animal substances, its properties being found to agree with those hydrocarbons found in Boghead mineral. It evaporates at 340°; its specific gravity is 0·74, being the lightest liquid known. It is soluble in alcohol and ether, but does not dissolve in water. It has no smell, is tasteless, and is highly inflammable.

EUPODA, *u'-po-da* (Greek, web-footed), a family of coleopterous insects, so named from the great size of the thighs of many of the species. They feed on the stems and leaves of plants. In the tropics they are of great size and beauty. Many of the smaller species are British.

EURYATE, *u-ri'-a-te*, a genus of plants of the natural order *Nymphæaceæ*, or water-lilies. *E. ferox* has small red or violet-coloured flowers. The seeds of the fruit are roasted and eaten in China and India.

EUSTACHIAN TUBE. (*See* EAR.)

EUSTACHIAN VALVE, *u-stai'-ke-an*, a membranous semilunar valve separating the right auricle of the heart from the inferior vena cava. (*See* HEART.)

EUTERPE, *u-ter'-pe*, a genus of palms. The species *E. montana* is one of the cabbage-palms, so called because the young leaf-buds are boiled and eaten like cabbage.

EVAPORATION, *e-vap-o-rai'-shun* (Lat., *evaporatio*, an evaporation), the conversion of liquid or solid bodies into elastic vapours or gases by means of heat. Evaporation goes on slowly or rapidly according to circumstances. Water evaporates gradually at ordinary temperatures all over the surface of the globe. It rises in the air as vapour, and when condensed by change of temperature, forms rain or dew, and descends again to the earth. When, however, evaporation takes place rapidly, as in the case of ebullition, it is generally called *vaporization*. The quantity of vapour which rises from the surface of a liquid in the open air not only depends upon the quantity of surface exposed, but also on the state of the atmosphere at the time. In warm and dry weather, both in winter and summer, evaporation is greatest. It was found by Dr. Dalton that water raised to 212° evaporated at the rate of 4·244 grains per minute. Mercury does not evaporate till it is raised to 60° or 80°.

EVECTION, *e-vek'-shun*, a lunar inequality resulting from the combined effect of the irregularity of the motion of the perigee and the alternate increase and decrease of the eccentricity of the moon's orbit. (*See* MOON.)

EVERGREENS, *ev'-er-greens*.—Trees and shrubs which do not shed their leaves in autumn, but retain their verdure throughout the winter. Firs, heaths, laurels, rhododendrons, bay, holly, myrtle, and ivy are very familiar examples. The leaves of evergreens are generally of firmer texture than those of deciduous trees and shrubs.

EVERLASTING FLOWERS.—A popular name given to some plants of the order *Compositæ*, the flowers of which may be dried and kept for a long period without losing much of their beauty. The name is sometimes applied to various species of cudweed; but the plants mostly belong to the genus *Helichrysum*, which contains a great number of species, none natives of Britain. The *Immortelles* woven into circular wreaths and placed on graves are forms of the everlasting flowers.

EVIL, KING'S. (*See* KING'S EVIL.)

EVOLUTE AND INVOLUTE, *ev'-o-lute, in'-vo-lute*.—Terms applied relatively to particular curves, the nature of which has been thus simply described. If a string be closely wrapped on a curve, fastened at one end and free at the other, the curve described by a pencil attached to the free end as the string is unwound, is called the involute of the first curve, which is known as the evolute.

EVOLUTION AND INVOLUTION.—In Algebra, the former term is applied to the extraction of roots, and the latter to the raising to powers. (*See* EXTRACTION OF ROOTS.)

EVOLUTION OF SPECIES.—The theory of development elaborated by Darwin, but partially anticipated by Lanarck and others, which asserts that the various species of plants and animals, instead of being each specially created and immutable, are continually experiencing change through a process of adaptation, by which these varieties of a species that are in any way better adapted for their conditions of life survive and multiply at the expense of others. This theory is sometimes expressed in the phrase, "survival of the fittest." Darwin considered that all existing species may have descended from one—or, at any rate, a very few low forms of life. (*See* SPECIES.) Evolution of more complex from more simple organisms does not necessarily form a linear series; and, with regard to the theory of the origin of many animal and vegetable forms from a common stock, some members of a group commonly manifest such modifications as render them permanently unlike their kindred, of whom the majority retain for a longer or a shorter time their original characters. Evolution does not mean change of matter as well as of the relation of its parts; fresh matter not being essential to it, since the phenomena are, as a matter of fact, re-arrangements of that which exists.

In Astronomy, the nebular theory includes the evolution of planetary bodies from incoherent fragments, which not only come into relation with each other, but in the process become grouped together so that the mass comes to consist of parts.

In Geology, evolution means not merely change in obedience to constant laws, but change under the influence of laws, the operation of which varies with the conditions under which they act.

EWE, *yu*, the female of the sheep. (*See* SHEEP.)

EXANTHEMATA, *ex-an-the'-ma-ta* (Gr., to come out in a rash). A class of febrile diseases attended by eruptions on the skin, small-pox, measles, and scarlet-fever are well-known examples.

EXCRETION, *ecks-kre'-shun*, the throwing off by means of the skin, the kidneys, and bowels of the human body, such matters as if retained would be injurious to health.

EXHAUSTIONS, METHOD OF, *egz-hawst'-yuns.*—A mode of proving mathematical propositions regarding quantities by continually taking away parts of them. The method was frequently employed by the ancient geometers.

EXIDIA, *ek-sid'-e-a*, a genus of Fungi. The species *E. Auricula Judæ*, Jew's ear, is reputed to possess astringent and discutient properties, when applied externally as a decoction or poultice. *E. hispidula* is used in China as a styptic, and as food mixed in soups and hashes. It is known there under the name of *Moghi*, which signifies "ears of trees."

EXOGENS, *eks'-o-jens* (Gr., *exo*, without; *ginomai*, I am formed), plants with stems that increase by external concentric layers—as the beech, ash, and oak. The class *Exogenæ* of some botanists corresponds with the class *Dicotyledones* (which *see*).

EXOGONIUM, *ex-o-go'-ne-um* (Gr., *exo*, without; *gonia*, angle), a genus of *Convolvulaceæ*. The species *E. purga* is a native of Mexico, near Chincanquiaco. Its tubercular roots constitute the true jalap of the Materia Medica, so well known as a purgative.

EXOSMOSE, *eks-os'-mose* (Gr., *ex*, out of; *osmos*, impulsion), the passage from within outwards of fluids or gases through a membranous separation. (*See* ENDOSMOSE.)

EXOSTEMMA, *exks-os'-tem-ma*, a genus of trees and shrubs of the order *Cinchonaceæ*, natives of America. Caribbee bark and St. Lucas bark, valuable febrifuges, are obtained from trees of this genus.

EXOSTOSIS, *eks-os-to'-sis* (Gr., from *ex*, out of, and *osteon*, a bone), is a term applied to a morbid enlargement or hard tumour of a bone. This term is applied properly only to osseous tumours on the bones, though it is also sometimes applied to other morbid growths. Exostoses are easily distinguished from other swellings by their being fixed and immovable, and at first unattended with any pain or inconvenience. There are three varieties—the solid, the hollow, and the foliated. There is no bone that may not become the seat of this disease, though some are much more subject to it than others. No external treatment is of any benefit in this disease; and when it is necessary that they be removed, and can be done with safety, it is effected by sawing or cutting.

EXPANSION, *eks-pan'-shun* (Latin, *expansio*), a term applied to the enlargement or increase of bulk in bodies, generally produced by heat. This effect is one of the most common and obvious results of the raising of temperature in all bodies, solid and liquid. Among the solids, the metals are the most expansible by heat. In most cases all bodies contract when the temperature is lowered; but there is a remarkable exception to this rule in the case of water, which begins to expand when lowered to 40° Fah. (*See* WATER.) Aëriform bodies are the most expansible forms of matter.

EXPECTATION OF LIFE, *ex-pek-ta'-shun.* (*See* PROBABILITY.)

EXPECTORANTS, *eks-pek'-to-rants* (Lat., *ex*, out of, and *pectus*, the chest), substances which promote the expulsion of mucus, or other matters, from the air-passages of the throat and chest. Vapours are the only agents that can act directly upon the organs affected; those that are taken into the stomach being only capable of acting in an indirect manner. The inhaling of the vapour of warm water simply, or mixed with certain medicinal substances, as vinegar, is very useful in this way. Most medicines which, taken in large doses, act as emetics, are used as expectorants. The expectorant most commonly used in ordinary cases is the syrup of squills. All substances, also, which excite irritation at the upper part of the windpipe, and produce coughing, act as expectorants. When there is decided inflammation, the best expectorants are such as lessen the inflammatory state.

EXTRACTION OF ROOTS.—(*See* CUBE and SQUARE ROOTS.)

EXTRAVASATION, *eks-trav-a-sai'-shun* (Lat., from *extra*, without; and *vas*, a vessel), a term applied to fluids which are out of their proper vessels or receptacles. Thus, an extravasation of blood takes place when an artery or vein is injured, and the blood escapes into the cellular membrane; and an extravasation of urine, when, in consequence of a wound or ulceration, that fluid makes its way into the cellular substance, or among the abdominal viscera. Extravasation is distinguished from exudation, in that, in the latter case, the walls of the vessels remain entire, and the fluids escape by secretion. The discolouration that follows contusions is occasioned by the extravasation of blood into the cellular tissue under the skin, from the rupture of small blood-vessels.

EXUVIÆ, *egs-u'-ve-e* (Lat.), a word applied to the cast-off skin of any animal, reptile or shell-fish, which is "shed." In the more warm-blooded classes, the moulted feathers of birds and the hairs of various species of *mammalia* may be looked upon as *exuviæ*, or exuvial deposits; as also the small scales of what is termed scarf-skin, which are continually cast off from our own bodies.

EYE, *i* (Ang.-Sax.), the organ of vision is one of the most wonderful and delicate portions of the animal body. It is placed within a bony cavity, termed the orbit, pyramidal in form, with the base anteriorly, and directed a little outwards, and the apex backwards and inwards. The orbit contains the globe of the eye, with numerous muscles, nerves, vessels, fat, &c. The external appendages of the eye are the eyebrows, eyelids, and lachrymal apparatus. The eyebrows, or *supercilia*, are arches of hair covering the supra-orbital ridge of the frontal bone on each side, and extending from near the root of the nose to a little beyond the outer canthus of the eye. They serve to prevent the sweat from falling into the eyes, and to protect them against a strong light The eyelids, or *palpebræ*, are two thin curtains which cover the eye, the one being inferior, the other superior. Where they join outwardly is called the *external*, and inwardly towards the nose the *internal canthus*. The margin of the eyelids, which is cartilaginous, is called *tarsus*. Along the margin of each eyelid is a row of stiff hairs, termed *cilia*, or eyelashes and which serve to keep external bodies out of the eyes, and moderate the influx of light. Within the lids, near their edges, are numerous glandular bodies, named after their discoverer, the *Meibomian* glands, and secrete an oily or mucilaginous fluid, which lubricates the eyes and lids, and facilitates their movements. The lachrymal gland is situated in a small depression of the frontal bone near the external canthus, and from it seven or eight canals issue, called the lachrymal ducts, and open on the internal surface of the upper eyelid; it secretes the tears, which then pass along the surface of the eye to the *puncta lachrymalia*, which are two callous orifices or openings, one in each lid, at the internal angle of the tarsus. From the lachrymal points the tears are conveyed by the lachrymal canals into the lachrymal sac, which is a membranous receptacle situated in the internal canthus of the eye. The nasal duct is a membranous canal, extending from the inferior part of the lachrymal sac downwards, backwards, and outwards, into the cavity of the nose. The lachrymal caruncle (*caruncula lacrymalis*) is a small fleshy body, of a red colour, composed chiefly of mucous follicles, and situated in the internal canthus of the eye. The globe or ball of the eye is composed of membranes or coats, humours, vessels, and nerves. The *membrana conjunctiva*, or conjunctive membrane, is a delicate mucous membrane, lining the internal parts of the eyelids, and covers the whole of the anterior part of the globe of the eye. The outermost coat of the eye is the sclerotic (Gr., *skleros*, hard), so called from its hardness. It is a strong, dense, white, fibrous structure, covering about four-fifths of the ball, and leaving a circular deficiency in front, which is occupied by the cornea. The latter, so named from its horny appearance, is the transparent covering in front of the eye, its edges being slightly over-lapped by the sclerotic coat. Externally it is covered by the membrana conjunctiva, and internally it is in contact with the membrane of the aqueous humour. It is convex anteriorly and concave posteriorly, and is composed of several laminæ, or layers. The choroid membrane is of a black colour, and covers the internal surface of the sclerotic coat, with which it is loosely connected by connective tissue. Near its anterior margin it is thrown into numerous folds or processes, alternately long and short, and which lie upon the edge of the lens and anterior portion of the vitreous humour: they are called ciliary *striæ* or processes and conjointly the *corpus ciliare*. On the outer surface of the choroid are seen the ciliary nerves and long arteries; next come the veins called, from the peculiar manner of their arrangement, *venæ vorticosæ*): next is the *tunica Ruyschiana*, composed chiefly of ramifications of minute arteries, forming a beautiful network; and next to this is the *tunica pigmenti*, composed of pigment-cells, usually of a hexagonal form, and secreting on its inner surface the *pigmentum nigrum*. The retina, or inner coat of the eye, consists of three layers of membranes, the outermost of which, in apposition with the choroid, is an extremely delicate membrane, termed the *tunica Jacobi*. The middle one, *tunica nervosa*, is in reality the expansion of the optic nerve, and terminates at the edge of the ciliary processes. The inner coat is the *tunica vasculosa retinæ*, which is vascular in texture, and contains several minute branches of the central artery of the retina. On the inner surface of the retina, at the back of the eye, and in a line with the axis of the globe, is a circular yellow spot, called the *limbus luteus*, in the centre of which is an apparent orifice, named, after its discoverer, the *foramen* of Sömmering. The *iris* (Lat., a rainbow), so called from its variety of colour in different individuals, may be regarded as a process of the choroid, with which it is continuous, although the two membranes differ in structure. It is a thin, flat, circular, membranous curtain, hanging vertically in the aqueous humour in front of the lens, and having a central orifice, termed the pupil, for the transmission of light. Its anterior surface is coloured variously in different individuals, and its inner surface is lined with a substance resembling the pigmentum nigrum, called the *uvea*. It divides the space between the cornea and the lens into two chambers, communicating freely with each other through the pupil. The anterior chamber is about a fifth larger than the posterior, and is lined with a membrane, which secretes the aqueous humour. The external edge of the iris, by uniting with the choroid and sclerotic coats, forms a greyish circle, termed the ciliary circle or ligament. The iris is muscular in structure, and has great power of contracting or expanding the pupil, so as to admit more or less light into the interior of the eyeball. In the anterior and posterior chambers is the aqueous humour of the eye, which serves to distend the cornea to allow the free motion of the iris, and to direct the rays of light as they pass through it. The crystalline lens is a transparent body situated behind and opposite to the pupil, while its posterior surface is received into a corresponding depression on the fore-part of the vitreous humour. In form it is double convex, the posterior surface being more convex than the anterior; and it is invested by a transparent membrane called the *capsule*, which contains also a small quantity of fluid, called the *liquor Morgagni*. The lens consists of concentric laminæ, formed upon a hard, firm nucleus, and becoming softer as they tend to the outer surface. The vitreous humour, or *corpus vitreum*, lies in the concavity of the retina, occupying about four-fifths of the eye posteriorly, and being perfectly transparent. It is inclosed in the hyaloid membrane, which also sends numerous processes inwards, so as to divide it into a number of cells, and to equalise the pressure exerted on the different parts. It is penetrated by branches of the central artery of the retina. The eyeball is moved about in its orbit by six muscles, four of which are straight (*recti*) and two oblique—the superior and inferior. The four recti muscles have their origin at the apex of the orbit, and are inserted into the sclerotic coat near the cornea, above, below, and on either side. When acting together, they tend to fix and retract the eye; when separately, to raise, depress, or turn it to one side or the other. The superior oblique rises with the straight muscles, proceeds forwards to the upper edge of the orbit, where it passes through a small pulley of bone or cartilage, by which its direction is changed; and its course is then backwards, outwards, and downwards, to be inserted into the sclerotic coat. It serves to draw the eye downwards and outwards. The inferior oblique arises from a minute depression in the orbital plate of the superior maxillary bone, just within the margin of the orbit, at its lower part, whence it passes backwards, outwards, and upwards, to be inserted into the sclerotic, at its posterior part. Its action is to direct the eye upwards and inwards. The optic nerves, or second pair, after uniting to form the optic commissure, in which some of the fibres of each nerve cross to the opposite side, separate, and enter the optic foramen at the apex of the orbit. They pass through the sclerotic coat on the inner side of and below the axis of the eye, then through the choroid, and spread themselves out, and are lost or terminate in the retina. Branches of the third, fourth, fifth, and sixth pairs of nerves also proceed to the eye, for regulating the movements, &c., of the different parts. In sight, then, the rays of light in passing through the cornea are converged, so as to pass through the relatively small pupil, and impinge upon the lens, which, by the convexity of its surface and its greater density towards the centre, serves to converge the rays, and to correct the aberration. They then traverse the vitreous humour, and strike upon the retina. (*See* OPTICS.) The human eyeball (the head being fixed) is capable of a movement of 55 degrees sideways, upwards, and downwards. The greatest distance at which objects can be discerned by the human eye varies greatly, and it is not possible to speak with precision on the subject. The smallest square magnitude discernible by the ordinary eye is about 1-400th of an inch, but smaller bodies may be seen if they reflect light.

Comparative Anatomy of the Eye.—The eyes of animals of the class mammalia differ considerably from those of birds, insects, and fishes. In *mammals* the structure of the eye is almost identical with that of man; but there are occasional modifications suitable to the peculiar requirements of the animal. The eyes of *birds* are not spherical as in the mammalia, but flattened anteriorly. The cornea is very prominent, and there is a much larger proportional amount of aqueous humour, and a greater distance between the lens and the posterior part of the retina. A series of bony plates extend backwards from the margin of the cornea, and are embedded in the sclerotic. These plates, acted upon by the muscles of the ball of the eye, cause a protrusion of the aqueous humour and of the cornea, adopting the eye for near vision; and relaxation of the muscles causes a recession of the humour and flattening of the cornea, fitting the eye for distant vision. This power of varying the focal distance is of great use to birds, especially birds of prey. Birds have also a lower as well as an upper eyelid, and an elastic fold, which in a state of repose lies in the inner angle of the eye, termed the *membrana nictitans*. The chief peculiarity of the eye of a *fish* is the size, extreme density, and spherical shape of the lens, which magnifies objects so considerably that it has been used as a simple microscope. The pupil is large, but generally motionless, and there is no lachrymal apparatus, none being necessary as the eye is constantly washed by the water in which fishes live. *Insects* have simple and compound eyes usually associated in the same individual. The simple eyes have a general resemblance to those of animals of the higher order. The compound eyes are wonderful structures, consisting of an extraordinary number of hexagonal facets or corneæ. Some beetles have more than 25,000 of these facets—each a perfect organ with lens, iris, pupil, and a nervous apparatus—in each compound eye. Many of the *crustaceans* also have compound eyes.

EYE, DISEASE OF THE.—This organ, from its delicacy and the numerous parts of which it is composed, is subject to a great variety of diseases, most of which will be noticed under their own names in different parts of this work. (*See* AMAUROSIS, LACHRYMAL ORGANS, OPHTHALMIA, SQUINTING, &c.) We shall here, therefore, only give an account of *cataract*, which has been referred to this place. It is derived from the Greek verb *katarasso*, I disturb or confound, and is usually defined to be a weakness or interruption of sight, produced by opacity of the crystalline lens or its capsule. Sometimes it is applied to every perceptible obstacle to vision situated in the posterior chamber between the vitreous humour and the uvea. When the disease is situated in the lens or its capsule, it is called a true cataract; but when it consists of opaque matter deposited in front of the lens, it is termed spurious. The latter arises from inflammation, and is to be treated by the usual means employed for allaying inflammation; but no operation can be of use in such a case. Of true cataract three kinds are distinguished;—*lenticular*, affecting the lens alone; *capsular*, affecting the capsule; and *capsulo-lenticular*, affecting both lens and capulse. Lenticular cataracts are of two kinds—*hard* and *soft*; the former being the more common, especially among elderly persons, and is usually of an amber-colour or brownish tint, and generally deep in proportion to its firmness. Soft cataract prevails in childhood and middle life, and occurs more frequently single than the other. A cataract may be occasioned by active inflammation or external violence, or it may arise from internal or unknown causes. Frequently it proceeds from an hereditary disposition which has existed for several successive generations, and sometimes it attacks several members of the same family, without any evidence of its being hereditary. The habitual examination of minute objects in a depending position of the head, by which an undue proportion of blood is thrown upon the organ, is said frequently to bring on cataract. It may make its appearance at any age, but is most frequently in elderly persons, though children are by no means exempt from it, and may be even born with it. It comes on without pain, and the symptom first perceived is a dim haziness of sight, as if a mist or thin film were interposed between the object and the eye. The obscurity is greatest in direct vision, the opacity being almost always first noticed in the centre of the pupil. Hence the sight is better in a weak than in a strong light, because in the former case the pupil is enlarged, and admits the passage of the rays through the less opaque edge of the lens. Hence, too, the remarkable effect produced by the application of belladonna to the eye, which has the power of dilating the pupil and producing a temporary improvement in the sight—a means sometimes had recourse to by quacks, who profess to be able to cure this disease. There is no medicinal remedy that is known to have any effect upon this disease, nor is it at all likely, from the structure of the parts, that any such remedy exists. All palliative measures, therefore, are confined to attention to the general health of the patient and the removal of any inflammatory symptoms that may exist along with it. The only mode of cure is actual removal by an operation; but so long as one eye remains unaffected, the operation may be delayed. There are three modes of operation employed for the removal of cataract, each of which has its advocates, and any one of which may be best, according to circumstances. The first is by *extraction*, or the removal of the lens, and is effected by making an incision through the cornea as near the iris as possible, and then, by means of a needle, opening the front of the capsule, and gently removing the lens. The second method is the displacement of the lens from the axis of vision by what is called *couching* (Fr., *coucher*, to lie down) or *depression*. A needle is inserted through the fore part of the white of the eye, and is brought to bear upon the lens, pressing it back and down into the vitreous humour; and the opaque body being thus removed, sight is restored. The third method, by *absorption*, is effected by puncturing the front of the capsule, and thus admitting the aqueous humour to act upon the cataract; by which means it is absorbed. All these operations require great care and skill in the operator, and the setting in of inflammation has to be specially guarded against.

EYEBRIGHT, *i'-brite*, a genus of plants (*Euphrasia*) of the natural order *Scrophulariaceæ*. Some are root parasites. The common eyebright (*E. officinalis*) is the only British specimen. It is a little plant, six or seven inches high, with white or reddish flowers, streaked with purple, appearing singly in the oxits of the leaves. In mountainous regions the plant is very minute. It is in great repute in rustic domestic medicine as a cure for diseases of the eye. Milton refers to it as "euphrasy."

F.

FAAM, OR FAHAM, an orchid (*Angræcum fragrans*), native of India and the Mascarene Isles. The fragrance of its leaves makes it much valued in the east; and in some parts an infusion of the leaves is considered to be a cure for pulmonary consumption and some affections of the stomach. The leaves are sold in France, under the name of Isle of Bourbon Tea, as an expectorant and anti-spasmodic.

FABA, *fai'-ba* (from Gr., *phago*, I eat), the Bean, a genus of the natural order *Leguminosæ*, sub-order, *Papilionaceæ*. From the species *F. vulgaris*, formerly regarded as *Vicia faba*, all the cultivated varieties of the broad bean have been produced. The earliest garden variety is named the Mazagan, and the largest the Windsor. Of the field bean there are two sorts, the smaller being called *ticks*. Beans are largely used in feeding cattle, and are very nutritious. The garden beans form an important article of human food.

FABACEÆ, *fai-bai'-se-e*, a synonym for the natural order *Leguminosæ* (which *see*).

FACE, *fais* (Fr., *face*; Lat., *facies*; Ital., *faccia*), in Crystals, the terminal planes of a regular solid: thus, the cube has six faces, or flat surfaces.

FACIAL ANGLE. (*See* ETHNOLOGY.)

FACTOR, *fak'-tor* (Lat., *facere*, to form), in Mathematics, a term applied to each of the quantities which are multiplied into one another; in other words, to the multiplicand and the multiplier, in order to form a product. The term factor is also used in the same sense as divisor; so that any quantity that will divide another is a factor of it. The entire factors of 12 are 1, 2, 3, 4, and 6. Taken in pairs, the factors are 1×12, 2×6, 3×4, &c. The prime factors of a quantity are those factors which cannot be exactly divided by any other quantity except 1. Every number has 1 for a prime factor.

FACULÆ, *fak'-u-le* (Lat., *facula*, a torch). Spots brighter than the rest of the surface sometimes seen on the sun's disc.

FÆCES, *fe'-ses*.—The solid excrement ejected by animals from the intestinal canal, consisting mainly of such portions of food as are worthless in the office of nutrition.

FAGOPYRUM, *fai-go-pi'-rum*, the Buckwheat, a genus of *Polygonaceæ*. The fruits of *F. esculentum* and *tataricum* are used as a substitute for corn in the north of Asia and eastern Europe. The former species is cultivated in Britain as food for pheasants.

FAGUS, *fai'-gus*, the Beech, a genus of trees of the natural order *Cupulifera*. There are not many species, but all are forest trees of great beauty. The common beech (*F. sylvatica*) grows to a height of more than 100 feet, and has a trunk frequently four feet in diameter. It is a noble looking tree, with very long branches which often droop almost to the ground. In many parts of Europe there are large forests of beeches. The bark is smooth, often of a whitish colour, and the tree is remarkable for the number of hard wooden knobs, abortive branches, which occur in the bark. The leaves are thin and ovate with fine bristles on the margin. The male catkins are almost globular in shape; and the female flowers grow on the same tree. When the flowering is over, a sort of capsule is formed, which when ripe contains one or two nuts of a triangular shape, known as beechmasts. Light soils are best adapted to the beech, the roots of which do not go deeply into the ground, but spread horizontally under the surface. The timber is hard, but best adapted for weirs, sluices, &c., as it is very durable under water, but it is very liable to rot and the ravages of insects in dry situations. Cabinet-makers and turners use it for the framework of chairs and couches and for ornamental work; and in France the *sabots*, or wooden shoes, worn by the peasantry are almost invariably made of beechwood, because it does not absorb damp. The ashes yield large quantities of excellent potash; and raspings of the wood are used in the preparation of vinegar. The beech is a native of Europe, except in the coldest parts, and of the temperate parts of Asia and North-America. In Tasmania and Terra del Fuego, the beech (*F. betuloides*) is an evergreen. The beech of North America (*F. ferruginea*) forms extensive forests, and the timber is more valuable than that of the white beech.

Fagine.—A volatile, narcotic, poisonous principle found in the beechmast, chiefly in the rind. When the rind has been removed, the beechmast affords wholesome food for swine and poultry. It has a sweet taste, and contains a fixed oil, a starchy farina, sugar and an astringent substance. The oil, obtained by pressure, and well clarified, is sometimes used in cookery, but more commonly for lamps and in some manufactures.

FAINTING, OR SYNCOPE, *faint'-ing, sin'-kope* (Gr., from *sun*, with, and *kopto*, I fall down).—A sudden and total or partial unconsciousness, resulting from impaired circulation of the blood through the brain, occasioned commonly by diminished action of the heart. The functions of the nervous system, respiration, and the action of the heart, are either suspended or very much diminished in force. The causes of fainting are various; as any strong mental emotion, loss of blood, severe pain, or anything which tends to diminish the vital energy of the system. Usually the patient is first conscious of a singing in the ears, then the sight becomes confused and all the senses deadened; the countenance becomes deadly pale, and the limbs are unable to support the weight of the body, which sinks to the earth. Fainting, if occasioned by a diseased state of the brain or heart, or, if prolonged, may result in death; but if arising from any trivial cause, the patient in general speedily recovers. The patient should be laid on the back, with the head low, and the dress loosened about the neck; abundance of fresh air should be admitted, and cold water may be sprinkled on the face and neck, or ammonia applied to the nostrils. (*See* HEART, DISEASES OF THE.)

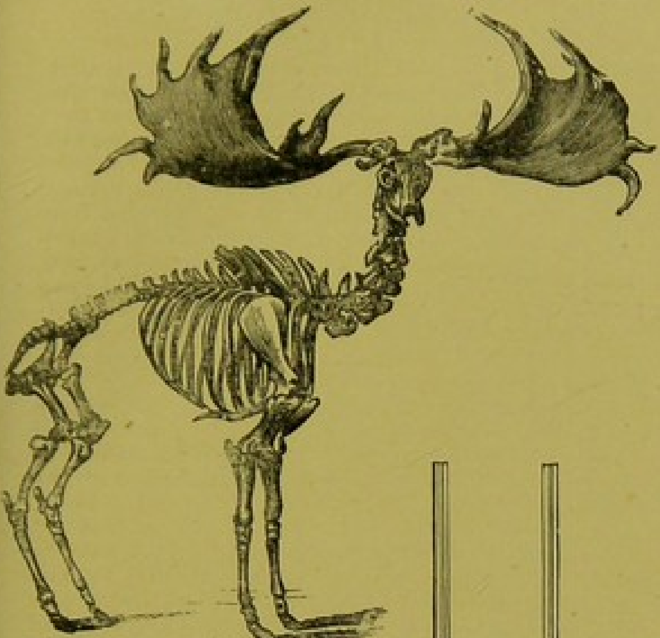
FALCON. (*See* FALCONIDÆ.)

FALCONIDÆ, *fal-kon'-i-de.*—Birds of this genus are distinguished from all other members of the family by the existence of a slight festoon on the lateral margin of the upper mandible, and also of an acute tooth on each side towards the apex. The wings are very long and pointed, the second and third quills being the longest; the tail is long and rounded: the tarsi is of moderate length, stout and reticulated; the toes usually elongated, and terminated by long curved and acute claws. The tongue is fleshy, sloped, and canaliculated. The falcons proper are distinguished from the ger-falcon by a tooth more strongly defined on each side of the upper mandible, which, among the others, is a mere festoon; the lower mandible is also much more sloped at its point than in the true falcon. The falcons are found in all parts of the world, and the number of species is very large. Their flight is very swift, and their courage certainly greater than that of other rapacious birds. Their flight is performed by regular continuous beats, with little or none of that sailing motion which characterises the kites. In capturing their prey, whether in the air or on the ground, they descend perpendicularly upon it. Their food consists, for the most part, of small quadrupeds and birds; but many of them also feed partly on reptiles and insects. The nests of these birds are rough and bulky, composed of sticks and twigs placed in the hollows of rocks or in trees. The eggs are usually laid at the close of winter or very early in spring: they vary in number from three to six, and are generally speckled with red or brown. (*See* GER-FALCON, GOSHAWKS, &c.)

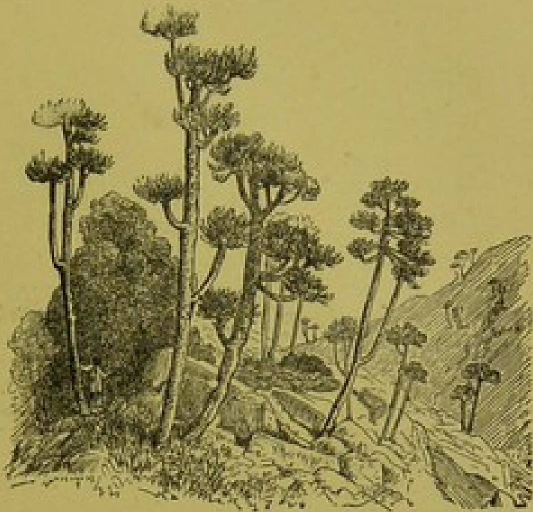
FALL OF BODIES, *fawl* (Ang.-Sax.).—When a body is allowed to drop through the air from a great height, or is thrown upwards, or through the air in any direction, the course which it takes, and the rapidity of its motion from or towards the earth, is regulated in all cases by certain laws. The motion of a body projected through the air in a horizontal or oblique direction, and the path which it describes, are considered elsewhere (*see* PROJECTILES, THEORY OF); and it will be sufficient here to examine the rate of motion of a body moving towards or from the earth in a vertical line. If a person were to stand on the top of a very high tower, and drop a ball from his hand, it would fall to the earth, moving much more rapidly as it approached the ground than it did when it was first dropped from the hand at the top of the tower. Its motion downwards is found to be what is termed an uniformly accelerated motion; that is to say, a motion continually increasing at a certain rate; or, in other words, if a body be moving at a certain velocity at the expiration of one second from the point of time at which it was allowed to fall, it will be moving twice as fast at the expiration of two seconds, three times as fast at the end of three, and so on. Experiments have shown that the rate per second at which bodies acquire velocity if moving downwards through the air, or lose velocity if moving upwards, is $32\frac{1}{6}$ feet. (*See* GRAVITATION, PENDULUM.) This velocity acquired by a falling body in a second of time is called the measure of the accelerating force, which force is produced by the attraction of the earth. The velocity of a body at any period of its fall may be ascertained by multiplying the rate of motion at the end of the first second, or, as it is generally called, the measure of the accelerating force, by the number of seconds during which it has been falling. The velocity of a body at any period of its fall being known, the space or length through which it has fallen may be ascertained by multiplying the velocity at that period by the number of seconds during which it has been falling, and dividing the result by 2. Thus, if a body has been falling from a state of rest for 5 seconds, its velocity at the end of the fifth second will be $32\frac{1}{6} \times 5 = 160\frac{5}{6}$ feet per second; and the space through which it has fallen will be $160\frac{5}{6} \times 5 \div 2 = 402\frac{1}{12}$ feet. If a body be thrown from the hand with considerable force, instead of being dropped in the direction of the ground, its velocity at any period of its course will be found by adding the rate of motion that it would have attained at the end of any number of seconds, if allowed to fall from a state of rest to the initial velocity imparted to the body at the moment when it was launched from the hand. If a ball be thrown upwards into the air at a certain velocity, by a person standing on the earth's surface, its motion will become slower and slower, at the rate of $32\frac{1}{6}$ feet per second, until the force with which it has been propelled upwards is entirely counteracted and destroyed by the attraction of the earth, which now acts as a retarding force; and when its initial velocity has been thus exhausted, the ball will seem to be stationary for a very small fraction of time, and then descend, acquiring rapidity of motion at the same rate as a ball allowed to fall from the same height from a state of rest.

FALLING SICKNESS. (*See* EPILEPSY.)

FALLING STARS, *fawl'-ing*, meteoric bodies, supposed to be of a similar nature to aërolites. (*See* AËROLITE.) They appear to the observer to resemble stars suddenly falling from their position in the heavens, and vanishing after a flight of short duration, during which they seem to draw a brilliant train of light behind them. The diameter of these bodies is supposed to vary from 80 to 120 feet, and their rate of motion to



ELK (SKELETON OF).



EUPHORBIA.

ELDER.

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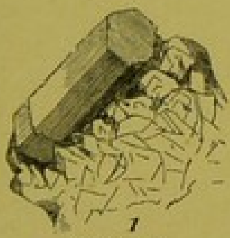

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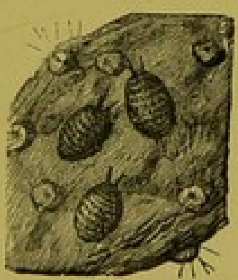

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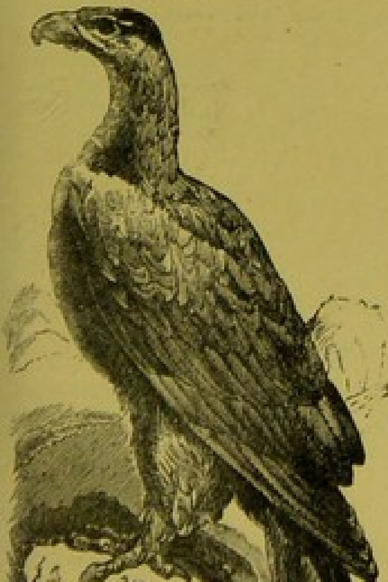

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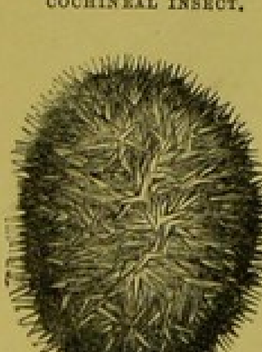
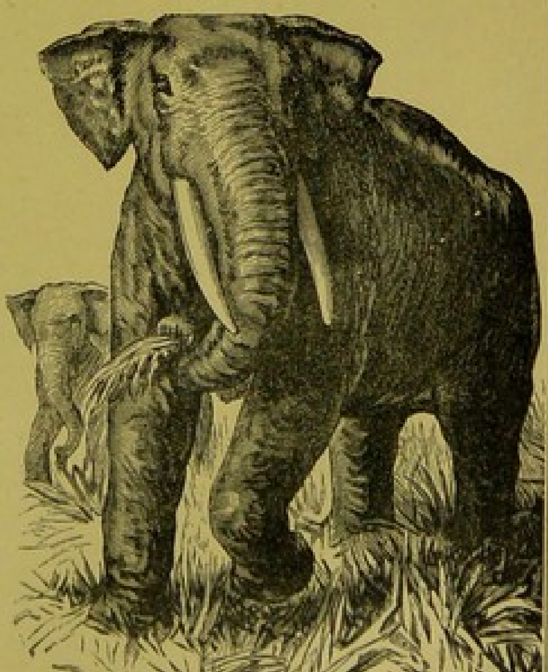


ECHINUS, OR SEA-URCHIN.



ELEPHANT.

be between 20 and 40 miles per second; their distance from the earth, when visible to the beholder as falling stars, is considered to range between 20 and 150 miles, beyond which limit they become invisible. They generally appear singly, but sometimes in great numbers, almost resembling a shower of fire. It is also supposed that they occur with greater brilliancy at intervals of about thirty-four years. The last extraordinary display took place in November, 1866.

FALLOPIAN TUBES, *fal-lo'-pe-an*, so called after the anatomist by whom they were first described, are slender tortuous canals, about four inches in length, proceeding from the upper angle of the uterus. Their inner, or attached extremity, is narrow and cordlike; but they soon begin to enlarge as they proceed outwards, and at length they bend backwards and downwards towards the ovary, about an inch beyond which they terminate in an expanded extremity, the margin of which presents a number of irregular processes, named *fimbriæ*, one of which, somewhat larger than the rest, is attached to the outer end of the corresponding ovary. They serve as ducts of the ovaries.

FALLOW DEER (*Cervus Dama*).—This animal may be distinguished from the stag by the spotted coat, the spread and palmated horns, and the smaller size. It seldom measures more than three feet high at the shoulder. Its colour is reddish brown, spotted with white; but there is a variety which is of a nearly uniform dark brown. It attains full growth at the age of three years, and is said to live twenty years. The fallow deer's native country is the south of Europe and the south-western part of Asia. (*See* DEER.)

FAMILY, in Botany, a synonym for Order (which *see*).

FAN PALM.—A common name for palms which have fan-shaped leaves.

FARCEY, *far'-se*, a disease of horses, generally accompanying glanders, appearing in the form of ulcers.

FARINA. (*See* FLOUR.) Also sometimes applied to the pollen of flowers collected by bees.

FASCINATION BY SERPENTS, *fas-se-nai'-shun*.—A power possessed by some serpents, of exercising a kind of mesmeric influence over small animals, which appear to render them incapable of motion, and so an easy prey. The possession of such a power was long doubted by naturalists; but recent observers consider it as established.

FAST, *fast* (Ang.-Sax., *fæstan*), a partial or total abstinence from food, a due supply of which is necessary to maintain the body in a healthy and vigorous condition. The length of time during which a person may subsist without food is very various, even though we give no credence to those remarkable instances, some of which seem to be well authenticated, that are given of life being maintained in the circumstances for a number of weeks. In 1880, a Dr. Tanner, in America, voluntarily fasted for forty days, as an experiment. (*See* HUNGER.)

FATA MORGANA, *fa'-ta mor-ga'-na* (Ital.), a singular phenomenon of unusual refraction, seen in the Straits of Messina. It is sometimes called "the castles of the fairy Morgana."

FATHER LASHER.—The *Cottus bubalis*, the most spiny of the British species of *Cottus*. When touched, it distends its gill-covers, and sets out strong spines on the back of the head. It is of a brown colour above, and white underneath, and is marked and spotted in a singular manner.

FATS, *fats* (Sax., *fæt*, fat).—In Chemistry, these important compounds are so nearly connected with the fixed oils, that it will be necessary to consider the properties of both under one head. The fats and fixed oils form a well-defined natural group of organic compounds, occurring abundantly both in the animal and vegetable kingdoms. Although, in common language, we speak of coal oils and essential oils, neither of these must be confounded, chemically, with the true fixed oils. (*See* OILS.) The vegetable fats and oils are found in various parts of the plant, but they are most abundant in the seeds. In animals, fat is found distributed through most parts of the body in warm-blooded animals, while in fish, and cold-blooded animals generally, its place is taken by oils.

Fat on the Human Body.—The quantity varies considerably at different periods of life, being least at the growing time, and generally most at middle age. Some persons, however, appear to accumulate very little fat, no matter what food they eat; while others grow enormously fat without any special reason being obvious. The chief chemical use of the fat on the body is its power of exciting and supporting the animal heat.

FATUITY, *fat-u'-e-te* (Lat., *fatuitas*, from *fatuus*, foolish), denotes foolishness or weakness of mind. The fatuous are distinguished from the imbecile, or idiots, in that the mental powers which they once possessed have been impaired or extinguished, whereas, in the case of the latter, the mental powers have been deficient from birth. There are various degrees and kinds of fatuity. It may amount only to some incoherence of ideas and words, or the patient may be deprived of all consciousness; it may merely enfeeble the intelligence or memory, or it may pervert the moral nature. (*See* INSANITY.)

FAUCES, *faw'-seez* (Lat., plural of *faux*), the gorge or back part of the mouth, terminated by the gullet.

FAULTS, *fawlts* (Fr., *faute*, defect), in Mineralogy, a miner's term for any fissure accompanied by a displacement of the strata. Slip, slide, heave, pitch, and throw are also common miners' terms for the same thing.

FAUNA, *fawn'-na*, a term employed by naturalists to express the whole of the members of the animal kingdom living in a particular district, or at a particular time. Thus all the animals living in Great Britain constitute the British fauna. Those inhabiting the land form the terrestrial fauna, and those inhabiting the seas, the marine fauna. It is often applied, collectively, to all the animals of the world, the extinct species constituting the fossil fauna, and the living species the recent fauna. The word is derived from the Fauni, who were supposed to be the patrons of wild animals.

FAUVETTE, *fo-vet'* (Fr.), a name partially adopted in the English language for some of the little song birds of the warbler family (*Sylviadæ*).

FAVOSITES, *fai'-vo-sites*, a genus of lamelliferous corals found in Silurian, Devonian, and carboniferous strata.

FAVUS, *fai'-vus* (Lat., honey-comb), a disease of the skin, most commonly appearing on the scalp, of a fungoid character, and marked by incrustations of a yellowish character. It destroys the bulbs of the hair, and baldness generally follows. Unless cleanliness is strictly attended to it is contagious.

FAWN, an appellation given to a buck or doe of the first year. (*See* DEER.)

FEATHERS, *feth'-ers* (Ang.-Sax.), the general name for the exterior covering of birds. They consist of the *quill*, the *shaft*, and the *vanes*. The quill is a hollow semi-transparent horny cylinder, by which the feather is attached to the skin. It combines strength with lightness in a very extraordinary manner. The cavity of the quill contains a series of conical capsules united together by a central pedicle, forming the membranous remains of the original formation-pulp. The *shaft* is quadrilateral, with a smooth convex surface; it contains a white, dry, and very light pith. The *vanes* are subdivided into two parts—the barbs and the barbules. The sides of the shaft are covered with the barbs, and each barb forms of itself a small shaft, which is covered in a similar manner with little barbs on each edge. Those barbules are so firmly bound to each other, that although, in reality separate, they seem to adhere. The feathers of birds are changed at periodical intervals. This is called "moulting." Feathers vary in their size, form, and function, and in most cases are accompanied by an accessory plume, which is usually in the form of a small downy tuft.

FEATHER GRASS.—A genus of grasses (*Stipa*), remarkable for the long awns which have a very graceful appearance. The common feather-grass (*S. pennata*), is a perennial and is cultivated as an ornament in gardens.

FEBRICULA, *feb-rik'-u-la* (Lat., a little fever), a fever of short duration and mild character, known also as Ephemera, or "fever of a day."

FEBRIFUGE, *feb'-re-fuje* (Lat., *febris*, fever, and *fugo*, I drive away), a medicine administered as a remedy for fever.

FECUNDATION OF PLANTS. (*See* REPRODUCTION.)

FEELERS, in Entomology. (*See* ANTENNÆ.)

FEIGNED DISEASES, *fained* (Fr., *feindre*, to feign), are diseases which certain persons pretend to be afflicted with in order to avoid some duty, or in the hope of gain. The soldier, to escape the performance of duty; the mendicant, to impose on public or private beneficence; the criminal, to avoid the infliction of punishment, most frequently have recourse to these pretences. They are sometimes, however, had recourse to when no adequate motive can be assigned, and are difficult of detection in proportion to the skill with which they are simulated; and Fodère has observed that during the conscription in France the imposture had been "brought to such perfection as to render it as difficult to detect a feigned disease as to cure a real one." The diseases most commonly feigned are epilepsy, catalepsy, convulsions, blindness, deafness, palsy, insanity, indigestion, neuralgia, rheumatism, palpitation of the heart, ulcers, &c. Vomiting, spitting of blood, diarrhœa, and ophthalmia, are also often simulated. It frequently demands very considerable ingenuity on the part of the physician to detect the knavery of such persons. Perhaps the strongest light is thrown upon these cases by an examination of the involuntary functions. In diseases in which the pulse ought to be affected (and there are few which do not affect it), its condition will often lead at once to a detection of the imposture. There is generally, also, an aversion in persons feigning disease to take the proper remedies.

FELIDÆ, OR FELINA, *fe'-le-de* (Lat., *felis*, a cat), a family of the Cat kind, of the order *Carnivora*, in which the destructive organs reach the highest perfection, including the cats, lions, tigers, leopards, and lynxes. In these animals the head is short and almost rounded in its form. The principal instruments of the destructive energy of these animals are the teeth and claws. The canines are long, sharp, compressed, and cutting; the præmolars are furnished with two roots, compressed, pointed, and serrated; the flesh-teeth, or true molars, are very large, sharp-edged, and terminated by two or three points; and behind the flesh-tooth in the upper jaw there is a small tubercular tooth, which is wanting in the lower. In addition to this formidable apparatus of cutting-teeth, the tongue in these animals is covered with small recurved prickles, by which they can detach from the bones of their prey every particle of flesh. The palate is soft, and that part of the tongue which corresponds with it is smooth; as it advances forward, it is covered with large soft papillæ directed backwards; then there are four large fessulate papillæ, anterior to which the simple conical papillæ continue increasing in size to near the tip of the tongue. These papillæ are armed with the strong cuticular spines before mentioned. The five toes of the anterior and four toes of the posterior extremities of the cats are armed with very strong, hooked, sub-compressed, sharp claws, which are preserved from being blunted by a peculiar arrangement of the phalanges. For this purpose the claw-joint of each toe is drawn back by ligaments attached to the penultimate joint, until it assumes a perpendicular position, when the claw which it supports is completely retracted within a sort of sheath, and is entirely concealed by the fur. When, however, the animal springs upon its prey, the tendons of the flexor muscles of the toes implanted into the opposite surface of the phalanx overcoming the elasticity of the retractile ligaments, push forward the claws, and they are ready to be buried in the flesh of a victim. The lower surface of the foot is furnished with thick ball-like pads of the epidermis, upon which the animal walks; and these are the cause of the peculiarly noiseless tread which is characteristic of all the members of this family. It will be seen, on reference to any members of the cat tribe, that the mode of walking adopted by these creatures is different from that of man, monkeys, or bats. The weight of the body rests only on the toes, and not on the entire foot. The manner of walking is termed "digitigrade," from the Latin words *digitus*, a finger, and *gradus*, a step. Cats hunt in the gloom, and consequently, while escaping observation, require every ray of light that can be made available. The pupil is a long vertica lfissure; but this only obtains among the smaller genera; for in all the *Felina* that surpass the ocelot in size, the pupil again assumes a round form. "On the top of the skull there runs a tolerably high bony crest, which reaches its greatest elevation at the very back of the head.

This bone-ridge is intended for the attachment of the powerful muscles which raise the head and enable the animal to perform its prodigious feats of strength. The first two vertebræ partake of a similar enlargement to that which has already been observed on the back of the skull. The vertebra which is nearest to the head, and is called the 'atlas,' is broad and strong, and spreads laterally; while the second, or 'axis,' is long, and is developed upwards into a very powerful crest. The ribs are beautifully formed, and placed rather widely apart, giving plenty of room for the heart and lungs to perform their duties effectually. The vertebræ that fill the space between the ribs and the hip-bones are very large, and so exquisitely jointed together that they unite a graceful flexibility of movement with great muscular power." The senses of sight and hearing are extremely acute. The bulbs from which the long hairs, popularly known as "whiskers," arise are very sensitive to touch, and the whiskers in consequence are very useful to the animal when making its way through thickets, or other obstructions. The *Felidæ* are distributed in all parts of the world, with the exception of Australia, but principally in the warmer regions, where alone the larger species are met with. (*See* various headings.)

FELSPAR, *fel'-spar*, an important mineral, and common constituent of rocks. It is the representative of a family, and consists essentially of a double silicate of alumina and some alkali, or alkaline earth. It forms a principal constituent of granite. Potash felspar is the orthose of the mineralogist, and gives rise to kaolin, or china-clay, by disintegration. Soda felspar is albite, lithia felspar petalite, and lime felspar labradorite. The term is derived from the German, and means *field-spar*.

FEMALE, *fe'-mail*, the offspring-bearing sex of animals. Females are generally smaller and weaker, and, especially in the case of birds, of less attractive appearance than the males. The last remark very obviously does not apply to human beings; neither is it generally applicable to the higher classes of domestic animals. The mare, for instance, is quite equal in appearance to the horse.

FEMALE FLOWER, (Lat., *femella;* Fr., *femelle*, female; *fleur*, flower), a term used to distinguish those flowers which are furnished with pistils, or female organs, but which have no stamens, or male organs of production.

FEMORAL, *fem'-o-ral* (Lat., *femur*, the thigh). A term applied to parts of or connected with the thigh; as, the femoral bone, or *os femoris*, the femoral artery, &c. (*See* THIGH.)

FENNEC, *fen'-nek* (*Vulpes zaarensis; Canis Zerda* of Zimmermann), belonging to the carnivora, and chiefly found in Nubia and Egypt. This animal, which has given rise to much controversy, is generally placed by the French zoologists among the foxes; but the observations of Mr. Yarrell led him to pronounce decidedly that the fennec appears to him to belong to the genus *Canis*, the osteological part of its structure closely resembling that of the dog, and the pupil of the eye being circular. The fennec is of slight build, and seldom measures more than a foot in length, exclusive of the tail, which is fox-like and bushy, and measures eight inches in length. Its colour is very pale fawn, with a slight touch of jetty black at the base and the extremity of the tail. Although without doubt a carnivorous animal, the fennec is especially fond of the fruit of the date-palm, and is said to be able, and frequently to exercise his ability, to climb the lofty trees, and gather the dates. Bruce, who claims the honour of introducing the fennec to zoological science, asserts that it builds its nest in trees. In later times, however, it has been certainly ascertained that it burrows like the foxes. It is of nocturnal habit.

FENNEL. (*See* FŒNICULUM.)

FENUGREEK, *fen'-u-greek*, a genus of plants (*Trigonella*) of the natural order *Papilionaceæ*, sub-order *Leguminosæ*, and allied clover. The common fenugreek (*T. fœnum Græcum*, "Greek hay") is a native of the south of Europe, and of some parts of Asia. It is used as fodder for cattle.

FEOFFMENT, *fef'-ment* (Lat., *feoffamentum*, from the verb *feoffare* or *infeudare*, to enfeoff, or give one a feud), in Law, is applied to the most ancient and solemn method of conveyance. It is defined to be "the conveyance of any corporeal hereditaments from one person to another by delivery of the possession of the hereditaments conveyed, and evidenced by an instrument in writing;" for since the Statute of Frauds, 29 Car. II. c. 3, no valid feoffment can be made without a written instrument. The person that so gives or enfeoffs is called the *feoffor*, and the person so enfeoffed is termed the *feoffee*. This mode of conveyance included a very material ceremony, called livery of seisin, without which the feoffee had but an estate at will. This was the actual delivery of a portion of the land or real hereditaments conveyed, as a twig or a turf, to testify to the reality of the act; or, the parties being within view of the land, the feoffer, referring to it, gave it to the feoffee. This latter mode of delivery was ineffectual unless the feoffee entered into possession during the life of the feoffor. (*See* CONVEYANCE.) Feoffments are now little used, and actual or symbolical livery of seisin is rendered unnecessary by 8 and 9 Vic. c. 106, by which corporeal hereditaments are made to be in grant as well as in livery, and which declares that a feoffment shall not have a tortuous or wrongful effect.

FERÆ, *fe'-re* (Lat., *ferus*, wild), a term employed by Linnæus to distinguish the order of mammalia which subsist more or less exclusively upon the flesh of other animals. (*See* CARNIVORA.

FERMATA, *fair-mai'-ta*, in Music, a pause or resting point, generally marked by a dot within a curve placed over notes, which are then prolonged.

FERNS, an order (*Filices*) of acrogenous or cryptogamous plants. (*See* ACROGENÆ and CRYPTOGAMOUS PLANTS.) It consists of herbs with rhizomatous stems, and of arborescent plants. The leaves, or *fronds*, as they are generally called, arise irregularly from the rhizome, or are placed in tufts upon the apex of the stem; they are almost always circinate in vernation, and are simple or compound. The fructification consists of little somewhat rounded cases inclosing *spores*. These cases are called *sporangia*, and are collected in heaps, usually on the under surface or at the margin of the fronds, or rarely on the upper surface, or occasionally in a spiked manner upon a simple or branched rachis. The order is commonly divided into three sub-orders; namely, *Polypodieæ*, *Danæaæ*, and *Ophioglosseæ*. Ferns are found in greater or less abundance in every part of the globe. In the northern hemisphere, they are herbaceous plants of small size; but in the southern hemisphere, and in the tropics, they are sometimes aborescent, having stems occasionally fifty feet or more in height, and with the general habit of palms. There are upwards of 2,500 species, and are divided by botanists into *Danæaæ*, *Gleicheneæ*, *Hymenophylleæ*, *Ophioglosseæ*, *Osmundeæ*, *Schizææ*, and *Polypodieæ*. The last-named includes the great majority of all ferns, including many British species. The Hymenophilleæ, Osmundeæ, and Ophioglosseæ are exclusively British. Ferns are much cultivated in greenhouses and closed glass cases (*see* WARDIAN CASE), and their graceful and tender green fronds form a charming ornament. Several ferns have farinaceous rhizomes or stems, which, in certain parts of the world, are roasted or boiled, and eaten in times of scarcity. The fronds of several species possess slightly bitter, astringent, and aromatic properties, and those of others are mucilaginous, as those of the Maidenhair fern, which is used for making capillaire. The rhizomes of some are astringent and tonic, and occasionally possess well-marked anthelmintic properties. The silky hairs found on the rhizomes and stalks of some species have been used for stuffing cushions and as mechanical styptics.

FERONIA, *fer-on'-i-a*, a genus of the natural order *Aurantiaceæ*. The species *F. elephantum* is a large tree, growing in India. A kind of gum, closely resembling gum-Arabic, exudes from its stem. The young leaves have an anise-like odour, and are used in India for their stomachic and carminative effects. The fruit is known as the elephant or wood-apple.

FERRET, *fer'-ret* (Du., *vret;* Fr., *furet*).—This well-known animal, *Mustela furo*, is a native of Africa, but domesticated in Europe. Its habits are similar to those of the weasel, but it is more blood-thirsty. Its length is about fourteen inches, exclusive of the tail, which measures about five and a half inches; snout sharp; eyes red and fiery; colour commonly pale yellow, but sometimes partaking of all the colours usual in the weasel kind. In slightness of body and shortness of leg it likewise resembles the weasels. Ferrets are chiefly used to drive rabbits out of their burrows. In the pursuit of this latter sport, it was the custom in olden time to *sew* the lips of the ferret together before it was turned into the right burrow, and so prevent it doing anything but scare them out of the hole and into the hands of the watcher at the mouth of it. The modern system, however, is to muzzle or "cope" the ferret. This is accomplished by the use of two pieces of soft string, one of which is passed round the neck, and the other under the jaws, the four ends meeting at the back of the neck, and being there tied. The ferret is always to a certain extent a dangerous animal, and even when supposed to be domesticated, is likely to attack young children. Poultry should be strictly guarded from them. Cold is fatal to the domesticated ferret. It breeds twice a year, the production ranging from six to nine young ones at a litter. Sometimes the female will eat up her young, and in that case she is likely to litter three times in the year. The period of gestation is six weeks. The young are born and continue blind during an entire month, and at three months old are considered fit for "work."

FERRUGINOUS, *fer-rugé-e-nus*.—A term denoting the presence of iron in mineral water. (*See* CHALYBEATE.)

FESCUE, *fes'-kew*, a genus of grasses (*festuca*), nearly allied to brome-grass, with many flowered spikelets. There are many species found in nearly all parts of the world, including many valuable pasture and fodder grasses.

FETID LIMESTONE.—A variety of limestone (popularly known as stinkstone or swinestone) which, on being violently rubbed, or struck with a hammer, gives out an odour like that of sulphuretted hydrogen gas.

FETLOCK, *fet'-lok* (Ang.-Sax., from *foot-lock*), a tuft of hair which grows behind the pastern-joint of most horses; horses of diminutive size, however, have hardly any tuft. The term is now more generally applied to the joint on which the tuft in question grows.

FEVER, *fe'-ver* (Lat., *febris*, from, *ferveo*, I am hot), is the name given to a very numerous and important class of maladies. Among the features that are almost always present are spontaneous and painful lassitude, weakness of the corporeal and mental faculties, alterations of the secretions, altered animal heat, quickened circulation, and increased thirst. One of the earliest and most constant symptoms of fever is lassitude, and is usually attended by a painful or irksome sensation in the back and limbs. It is manifestly referable to a depressed state of the nervous energy, more particularly as regards the organic nervous system. Some of the mental powers are more affected than others; as attention and the reasoning faculties, than the imagination. Alterations of the secreting and excreting functions are among the earliest and most constant, and most important phenomena of fever. The exhalations from the lungs and skin are the earliest and most affected; but, besides these, the salivary, gastric, hepatic, intestinal, and urinary secretions, are more or less altered as respects either quantity or quality; the alterations being somewhat different types and states of fever. The temperature of the body is also variously affected in the different stages. At first it is usually below, but it soon after rises above, the normal condition, and is generally accompanied with a certain morbid sensation which it is difficult to describe. Thirst is seldom wanting in fever, except occasionally in its advanced state; and the appetite for food is also diminished, or entirely abolished. Medical men distinguish various stages or periods in the course of fever which are characterized by features more or less marked; as (1) the formative or precursory stage, the earliest stage of the disease, being characterized by those early changes which are productive of those which constitute the developed disease; (2) the stage of invasion, when the earlier symptoms of the disease itself manifest themselves; (3) the period of excitement or reaction, when fever in its more literal sense begins, and manifests its specific form; (4) the period of crisis, when a sudden change takes place in the course of the disease, known as the crisis; (5) the period of decline which succeeds the crisis, and which passes into the (6) last stage—that of convalescence. Fever presents itself in a great variety of forms, the simplest of which is what is termed ephemera, or one day's fever. (*See* EPHEMERA.) If such an affection be supposed to recur several times every other day, with an interval of comparative health in the intervening days, a clear notion will be formed of *intermittent* fever in its most frequent and characteristic form—the tertian; and from the tertian may be derived all the other forms of intermittent fever. If, in the next place, the febrile state be conceived to be reinforced twice a day, or oftener, by a fresh attack of rigor or chilliness, with subsequent reaction before the pre-existing pyrexia had materially subsided, a distinct conception may be formed of remittent fever. From the remittent fever most nosologists deduce the only remaining primary type—continued fever, by supposing the remissions to become gradually less and less distinct; but others, with perhaps more reason, regard them as ephemera, merely prolonged to such a duration as that its several stages occupy between four and nine or eleven days. In accordance with these remarks, what are known as primary fevers may be divided into the three classes—continued, intermittent, and remittent fevers. The first class comprises synocha, or inflammatory fever; synochus, mixed, or nervous fever; and typhus, or adynamic fever. Intermittent fevers are divided into tertian, quotidan, and quartan; while remittent fevers comprise the marsh remittents, and probably also the yellow fever. Besides primary fevers, there are the irruptive class of fevers, comprising the small-pox, measles, and scarlet fever; and the irritative fevers, comprising gastric fever and gastro-intestinal, remittent, and hectic fever. (*See* various headings.)

FIBRE, *fi'-br* (Lat., *fibra*).—Animal, vegetable, or mineral substances which have a stringy or thread-like structure. In a general sense, it includes the hair and wool of quadrupeds, the threads enwrapping the cocoons of silkworms, &c., the fibres of the leaves of plants and of their inner bark, the elongated cells or hairs connected with the seeds of plants, and the ordinary materials used in making cordage and textile fabrics. Mineral substances are called fibrous in structure, even when it is impossible to detach the apparent fibres. The only fibrous mineral which has been used for textile fabrics is *Amianthus*, a variety of asbestos; but that only to a very limited extent. The animal substances used are divided into two classes; the first including hair and wool, and the second the silk of cocoons. Nearly all textile fabrics are made from the first, and the wool of the sheep is the most important division of the class. The hair of the goat, alpaca, camel, bison, and other animals, is also used. The hair of most animals is, however, in general, too short to allow of its being used for textile manufacture. The vegetable kingdom yields the largest number of useful fibres, which are obtained from natural orders very different from each other. The acrogenous or cryptogamous plants do not, however, afford any. From exogenous plants, fibres are obtained from the inner bark, as in the case of flax, hemp, &c., and from the hairs of the fruit, as in cotton. In endogenous plants, the fibre is sometimes obtained from the fruit, as in cocoa-nut fibre. The spathe of some palms is also used. Some of the slender palms called rattans, and the bulrush, &c., are much used, on account of their fibrous nature, for wicker-work, chair-bottoms, and similar purposes. The most valuable fibres obtained from endogenous plants come from the leaf or leaf-stalk. The fibres of the bark of exogens are readily separated, usually by steeping or continually moistening with water. As this process injures the colour of endogenous substances, the fibres are generally separated by heating or passing between rollers. Fibres obtained from fruits, as cotton fibre, like the wool and hair of animals, exist naturally in a separate state, and only require to be collected and cleaned. Amongst the useful vegetable fibres, those of flax, hemp, and cotton have long held the first place. The principal additions, of late years, have been New Zealand flax, jute, Sunn or Sunn hemp, coir, Pita flax, Abaca or Manilla hemp, China grass, and some others. One of the most important uses of vegetable fibre is in the manufacture of paper. Among exogenous plants whose fibres are used for economical purposes, are a species of gossypium which produces cotton; the *Bombax villosum*, which produces silk-cotton, or vegetable silk; and the *Asclepias syriaca*, producing the silk-like down of Virginian silk. These three substances are obtained from the fibres of the fruit. Those obtained from the inner bark include the following:—several species of Hibiscus, producing Deckanee hemp; the *Corchorus olitorius*, from which jute is obtained; the *Linum usitatissimum*, producing flax; several species of the Crotolaria; together with other leguminous plants, producing Sunn, Jubbulpore hemp, &c.; several species of Bœhmeria, one of which produces China-grass fibre; the *Cannabis sativa* producing hemp; and the inner bark and roots of some species of pine and fir. Among the endogenous plants from which fibres are obtained, are the *Phormium tenax*, yielding New Zealand flax; *Agave americana*, yielding Pita flax; some species of Musa, from the leaves of which are obtained Abaca or Manilla hemp, and plantain fibre; several species of Bromelia, from which are obtained pine-apple fibre, &c.; the husk of the cocoa-nut and the fibre of the stem yield coir; and mats, chair-bottoms, and other important articles in general use, are obtained from the fibre yielded by the leaves of the cotton-grass and other species of the natural order Cyperaceæ (which *see*).

FIBRIN, *fi'-brin* (from Lat., *fibra*, a thread), one of the constituents of the blood, and of muscular tissue. It occurs in two states—liquid in the animal organism, and solid by spontaneous coagulation, as soon as it is removed from the living body. It is contained in blood in a liquid state, in the proportion of 2·5 parts to 1,000, and coagulates in a very short time after the exposure of blood to the air. It constitutes a large portion of muscle, arranged in bundles of fibres; whence its name. According to Liebig, it is found in the juices of plants and in the gluten of wheat.

FIBULA. (*See* LEG.)

FICUS, *fi'-kus* (Lat., a fig), a genus of the natural order *Moraceæ*, consisting of trees and shrubs abounding in a milky juice. The most important species is *F. Carica*, the common fig, supposed to be a native of Asia Minor, but now found in all the southern countries in Europe. The fruit is termed a *cyconus* (which *see*), and is eaten green, and dried as a luxury in some countries, and as a common article of food in others. The finest dried figs are imported from Turkey, the best being known as Elemi figs.

In consequence of their nutritive, emollient, demulcent, and laxative properties, they are frequently employed in medicine. The fig-tree is cultivated in Britain, but not extensively. It is only in very warm situations that it will ripen its fruit in the open air, even though trained against a wall. When grown in houses built on purpose for it, the fig-tree is remarkably prolific. This fruit-tree is the *jennah* of the Bible. *F. Indica*, the banyan or banian tree, is another interesting species. (*See* BANYAN.) Its branches produce long shoots, or aëriel roots, which descend to the ground and penetrate the soil; so that, in course of time, a single tree becomes a vast umbrageous tent, supported by numerous columns. No fewer than 350 stems, each equalling in bulk the trunk of a large oak, and more than 3,000 smaller ones, have been counted in one example. The fruit of the banyan is of a rich scarlet colour, and about the size of a cherry; it is eaten by the monkeys, which live with birds and enormous bats in the thick forest of branches. The bark is a powerful tonic, and is much used by the Hindoo physicians. The white glutinous juice of the tree is used to relieve toothache, as an application to the soles of the feet when inflamed, and for making bird-lime. *F. elastica*, also a native of India, yields an inferior kind of caoutchouc. *F. Sycamorus*, the sycamore fig, is said to have yielded the wood from which mummy-cases were made.

FIELDFARE, *feeld'-fair* (*field* and *fair*, from Saxon, *faran*, to go) (*Turdus piralis*), a migratory bird, appearing among us about the beginning of November and departing at the end of April. It seldom breeds in this country. It is about the size of a blackbird, and of the following colours:—head, hind neck, and wings, grey; fore part of the back, chestnut; space before the eyes, brownish black; fore-neck and breast, reddish yellow; over each eye a whitish line; feathers tipped with a brownish triangular spot; those of the sides with large dusky spots, and margined with white; lower wing-coverts and axillary feathers, pure white. In Poland, Russia, and Austria, it is found throughout the year. It builds its nest in lofty trees, and feeds on worms and various berries.

FIG. (*See* FICUS.)

FIGHTING FISH, a small fresh-water fish (*Macropodus pugnax*) of the family *Anabasidæ*, a native of Siam and other parts of south-eastern Asia. It is remarkable for its love of fighting, and the Siamese find one of their favourite amusements in watching and betting on the fights of two of these fishes, kept in tanks for the purpose. The Siamese government licenses these fights, and derives a good amount of revenue therefrom.

FIGULINE, *fig'-u-line*. (*See* POTTER'S CLAY.)

FIGURE OF THE EARTH. (*See* EARTH.)

FILARIA, *fe-lai'-re-a* (Lat., *filum*, a thread), a genus of parasitic entozoa, common to large and small animals, and infesting even certain of the mollusca. Of this family the most inimical to the comfort of man is the Guinea-worm (*Filaria medinensis*), which, in hot climates, insinuates itself under the skin of the lower members, causing excruciating pain. It has a slender and thread-like body, and sometimes attains a length of six feet. It is met only in certain portions of the torrid and temperate zones in Africa and Asia, and is especially frequent on the African coast. At the meeting of the British Association for the advancement of science, in 1862, Dr. Cobbold stated that it was possible for one human body to contain 37,000,000 very minute organisms of this character.

FILBERT. (*See* CORYLUS.)

FILE-FISH. (*See* BALISTES and MONACANTHUS.)

FILICÆS. (*See* FERNS.)

FIN, *fin* (Sax., *finn*), a flat expanded organ, projecting from the bodies of fishes, and used as an instrument of locomotion in the water. The fins of fishes are supported by elongated filamentary bones or rays, by the number and nature of which the naturalist is able to distinguish the various groups. Many species of the whale tribe possess an immovable fin upon the back, composed merely of a reflexion of integument over a mass of dense and ligamentous cellular membrane. The tail fin has the same structure, but is moved by the action of muscles upon the caudal vertebræ, which are continued through the middle part.

FINCHES, *fin'-tshes* (Sax., *finc*), a family of birds belonging to the order *Passeres*, and the division *Conirostres*, and known by the general name of *finches*. This family embraces, in addition to the *Alaudinæ*, or larks, to which the buntings, or *Emberizinæ*, seem nearly allied, the greater part of the Linnæan *Fringillidæ*, with the Linnæan *Tanagrinæ* (tanagers), which approach these in their external characters and in their habits. None of the finches are of large size, and in their habits and general appearance there is a strong likeness. For the most part they are hardy birds. Their food chiefly consists of grain, worms, and insects. The characteristics of this family of birds are—beak straight, longer than deep, conic and pointed; mandibles nearly equal, cutting edges entire, forming a straight commissure; nostrils basal, lateral, oval, partly hidden by the frontal plumes; wings with the first quill-feather longer than the fifth, but a little shorter than the second or third, which are equal, and the longest in the wing; legs with the tarsi of moderate length; toes divided, and adapted for hopping and perching; claws curved and sharp.

FINSCALE, *fins'-kale*. (*See* RED-EYE.)

FIORIN, *fi'-o-rin*. (*See* BENT GRASS.)

FIR.—A name frequently applied to all trees of the natural order *Pinus*; but also, and in a more restricted signification, for the genus *Abies*. (*See* ABIES, CONIFERÆ, PINE, SPRUCE, FIR, &c.)

FIRE, *fire* (Sax., *fyr*), heat and light emanating visibly, perceptibly, and simultaneously, from any body.

FIRE-BALL, in Meteorology, globular masses of fire moving through the atmosphere. (*See* METEORS, and SHOOTING-STARS.)

FIRE-CLAY, a variety of clay capable of bearing a great heat without melting or vitrifying. This arises from the absence of any alkaline earth to act as a flux. Stourbridge clay is one of the most famous, and is used largely in the manufacture of glass pots. It contains 64 per cent. of silica, 24 of alumina; the rest being oxide of iron, water, and traces of carbonaceous matter.

FIRE-DAMP, a miner's term for the light carburetted hydrogen of the coal-mines, from its inflammability, in contradistinction to *choke-damp*, which chokes or extinguishes flame.

FIREFLY, a name commonly applied to those insects which have the power of emitting a luminous appearance from their bodies. (*See* GLOWWORM, &c.) They are all, except the lantern-fly (which *see*), coleopterous, and belong to the two nearly allied tribes, *Lampyrides* and *Elaterides*. Insects of this kind are very common in Mexico, where ladies use them as ornaments for head-dresses. The light emitted is so intense that one of them is sufficient to enable a person to read in the dark at a short distance from it. Examined in the spectroscope, the light gives a continuous spectrum, but without lines.

FIRE, ST. ANTHONY'S. (*See* ERYSIPELAS.)

FIROLA, *fi-ro'-la*, a genus of gasteropodus molluscs, of the order *Heteropoda* destitute of shell. They are very elongated, and the mouth is situated at the extremity of a proboscis. They are almost transparent, and have sometimes golden spots.

FISH, *fish* (Sax., *fisc*) (*Pisces*), a name applied to animals exclusively aquatic, and occupying the fourth and lowest station of the section *Vertebrata*. The head is large, and set upon the neck without the intervention of any distinct neck; the body is usually of a spindle shape, tapering gradually towards the extremity; and the surface is usually smooth, without any irregularities which might impede the motion of the creature in its native element. In its general form, the body is usually rounded, or slightly compressed at the sides; sometimes this flattening proceeds to a much greater extent, so that the animal presents the appearance of a broad band, or oval disc, of which the edges correspond with the dorsal and ventral surfaces; in other cases, the flattening takes place from above downwards, producing a disc-like body, of which the upper and lower surfaces are dorsal and ventral. A fish may be shortly defined as an animal breathing through the medium of water, by means of gills; and in giving it our consideration, this latter apparatus is the most important feature presented. It is situated on each side of the neck, and consists of numerous laminæ fixed on arches. These laminæ are covered with innumerable blood-vessels, and are so constructed as to present a considerable surface to the water, so that the blood may receive a sufficient portion of the oxygen contained in that element. As the water in contact with the gills becomes deteriorated, it is necessary that a constant current be caused to flow over them. In most fishes this is effected by their taking water in at the mouth and expelling it at the gill-covers. The blood, which is constantly sent from the gills to the heart, is distributed by means of the arteries to every part of the body, whence it returns to the heart by means of the veins. Animals of this order are for the most part furnished with an air-bladder in the interior of the body, which, as it is often connected with the œsophagus by a tube, must be regarded to a certain extent analogous to the lungs of the air-breathing vertebrata. This sac or air-bladder, however, has nothing to do with respiration; it receives blood from the arteries, and returns it into the veins, and the air which it incloses is probably derived from this fluid. By the dilation or compression of this sac, the specific gravity of the fish is governed, and, acted on by a curious muscular apparatus, renders its possessor lighter or heavier than the surrounding element. The limbs of the fish are formed into fins; the fore-legs constituting what are termed the pectoral fins, and the posterior extremities, the ventral. Besides these, ordinary fishes are furnished with one or two dorsal fins, an anal fin, and a caudal fin, or tail. In some fishes, the dorsal or median fins are continuous round the whole posterior portion of the body; and this is the condition in which these organs first make their appearance, during the development of the embryo in all fishes, the subsequent changes which take place in the arrangement of the parts being due to the unequal development of the bony rays, which support and stretch the membrane of which the fins are composed. The pectoral fin in all fishes consists of the same parts as the anterior limbs of any other vertebrated animal. Concealed within the skin, immediately behind the branchial openings, is found a bony circle, composed of several pieces, representing the shoulder-blade, with the coracoid bone and clavicle. This supports the bones of the arm, which are usually very short, and bear a series of carpal bones at their extremity; the latter supporting a number of short cylindrical joints, whence the rays of the fin take their rise. The internal supports of the ventral fins never present such a close resemblance to the pelvis of the higher vertebrata as do those of the pectorals to the scapular arch. When situated in their normal position in the abdomen, they always consist of cartilaginous or bony pieces, lying freely in the muscles, and quite unconnected with the vertebral column; but when the fins are advanced from this position to the neighbourhood of the pectorals, their internal supports are attached to the scapular arch of the latter members. The principal organ of motion is the caudal fin, or tail: by this it is propelled. The dorsal and ventral fins serve to balance it, and the pectorals to arrest its progress when required. The bones of fishes are of a less dense and compact nature than in the higher orders of animals, and always remain in an isolated state similar to that of the embryo of the mammalia. The skeleton may be divided into four chief parts—the vertebral column, the head, the respiratory apparatus, and the limbs. The vertebral column consists of vertebræ which are concave at each end and pierced in the middle; and, when joined together, the hollow space between each two is occupied by a gelatinous substance, which passes from one space to the next, through the hole in each bone. This hole is usually very small; but in some instances, it is so large that the bodies of the vertebræ are mere rings. To the vertebræ are attached the ribs: in fact the ribs are the main support of all the other bones. The head varies more in form than in any other class of vertebrate animals. The same bones as those found in other oviparous animals are almost always traceable. The upper jaw consists of maxillary and intermaxillary bones. In the greater number of fishes, the intermaxillary bones constitute the chief portion of the upper jaw, the maxillary bones being placed behind and parallel to them. The lower jaw is composed, generally, of two bones on each side, the dental portion in front and the articular portion behind. The form of the body is for the most part such as mechanical principles teach to be best adapted for moving with least resistance through a liquid medium. The surface of the body is either smooth and lubricous, or is covered by closely-imbricated scales, rarely defended by bony plates or roughened by hard tubercles, still more rarely armed with spines. The central axis of the nervous system presents but one partial enlargement, and that of comparatively small size, at its interior extremity, forming the brain, which consists of a succession of ganglionic masses, most of them exclusively appropriated to the function of a nerve of special sense. The power of touch can be but feebly developed in fishes. The organ of taste is a very inconspicuous one; the chief function of the framework, supporting it, or the hyoidan apparatus, relating to the mechanism of swallowing and breathing. Of the organ of hearing there is no outward sign; but the essential part, the acoustic labyrinth, is present, and the semicircular canal, largely developed within the labyrinth, is without cochlea, and is rarely provided with a special chamber, but is lodged in common with the brain, in the cranial cavity. The eyes are usually large, but are seldom defended by eyelids, and never served by a lachrymal organ. The alimentary canal is commonly short and simple, with its divisions not always clearly marked, the short and wide gullet being hardly distinguishable from the stomach. The pancreas, for the most part, retains its primitive condition of separate cæcal appendages to the duodenum. The heart consists essentially of one auricle and one ventricle, receiving the venous blood and propelling it to the gills; whence the circulation is continued over the entire body, in vessels only, which are aided by the contraction of the surrounding muscular fibres. The blood of fishes is red but cold, and is rarely elevated above the temperature of the surrounding element. The sexes of fishes, excepting the sharks and rays, offer no very decided external characters by which they may be distinguished. The respiratory organs, however, occupy more space in the males than in the females; and, on the other hand, the abdomen is larger in the females than in the males. Fish are oviparous, or egg-producing; but in some cases the eggs are hatched within the body, and the young produced alive. The chief reproductive organs are generally two elongated lobes, known as "milt" in the male, and "roe" (consisting of rudimentary eggs) in the female. Impregnation usually takes place after the roe or spawn is deposited. Many fishes are gregarious, swimming in enormous shoals; and some make periodic migrations. The fecundity of fish is very wonderful. The number of eggs in the spawn of a cod has been found to be about 91,000,000, and of a flounder, 14,000,000; of a mackerel, 540,000: and the salmon is far more productive still, the ovarium of one female salmon having been known to produce 20,000,000 eggs.

Fishes, Royal, or those which at common law are the property of the crown—are the whale and the sturgeon—when either thrown on shore or caught near the coast. In olden times, these fishes were considered too precious for a subject; and the right was strictly claimed by the sovereign, and is expressly mentioned in a statute referring to the royal prerogatives passed in the reign of Edward II. In the case of a whale, the head only was claimed by the king, the tail being reserved for the queen-consort.

FISH-HAWK. (*See* OSPREY.)

FISSIROSTRES, *fis-se-ros'-treez* (Lat., *findo*, I cleave; *rostrum*, a beak), the name of a tribe of birds, consisting of the swallows, swifts, and goatsuckers, distinguished by having the bill short, broad, depressed, slightly curved, without any tooth, and so deeply cleft as to give peculiar wideness to the gape; a structure of great use to birds which prey so exclusively on insects taken on the wing. On account of the food on which they subsist, all the fissirostres migrate from northern countries towards the close of autumn, and return again in spring.

FISSURELLIDÆ, *fis-sure-el'-i-de.*—A family of gasteropodus molluscs of the order *Scutibranchiata*. The shell generally resembles that of the limpet, but has either a hole at the apex or a slit at the front margin.

FISTULA, *fis'-tu-la* (Lat., a pipe or reed), a long and sinuous ulcer, having a narrow opening, sometimes leading to a larger cavity, and which has no disposition to heal. The most common form of this disease is the *fistula in ano*, the sinus extending into the cellular substance about the anus, or into the rectum itself. It is the result of abscesses formed in the cellular tissue around the rectum, and which, having burst or been opened, are prevented from healing by the action and irritation of the sphincter ani. They are divided into two kinds—complete and incomplete, or blind; the former having two openings or outlets, the one externally, the other into the rectum; the latter having only one, and being divided into blind external and blind internal, according as the opening is external or internal. This disease is commonly attended with intense pain, especially when passing the fæces, and there is an irregular discharge of purulent matter, which is sometimes mixed with blood. The treatment consists in making a complete division with the knife of the whole of the parts between the fistula and the bowel, and the edges of the wound are kept apart by lint, in order to allow the cavity to fill up by granulation. A *fistula lacrymalis* is a disease of the lachrymal sac, caused by an obstruction to the flow of tears along the nasal duct. The symptoms of this disease are a watering of the eye, with a dryness of the corresponding nostril, a distension of the lachrymal sac, and a discharge of muco-purulent fluid mixed with tears, from the puncta lachrymalia, when the sac is compressed. *Salivary fistula* is a fistulous aperture in one of the salivary ducts, opening externally, and through which the saliva escapes. It is generally caused by a wound, which, if recent, a cure may be effected by merely bringing together and uniting the edges of the wound; but if of some standing, a free canal ought to be formed for the discharge of the saliva into the mouth. In *fistula in perinæo*, which is almost always accompanied with a stricture of the urinary passage, the fluid passing out of the external opening of the sinus, an operation is necessary, which will require the aid of a competent surgeon. Fistulas generally require very skilful treatment and are often extremely difficult to close; and though not in themselves dangerous, they are not unfrequently attended with fatal results, arising out of the constitutional depression, which they occasion by the long-continued wearing pains, and the drain upon the system, in consequence of the protracted discharge. Fistula in ano is often observed in consumptive patients.

FISTULARIDÆ, *fis-tu-la'-ri-de*, known also as Flutemouth, a family of acanthopterous fishes, remarkable for the elongation of the skull into a tube, at the extremity of which are the mouth and jaws. One species (*Centriscus Scolopax*) is commonly named the Snipe-fish, the Sea-Snipe, or the Trumpet-fish.

FISTULINA, *fis-tu-lee'-na.*—A genus of Fungi, the under surface of which is at first covered with small tubercles, which afterwards become tubes. F. *hepatica* (so named from its resemblance, when decaying, to a mass of liver) is common on all trees, especially oak, walnut, and chestnut. It is of a red colour, semi-circular in form, and the substance resembles beet-root in appearance. Specimens weighing eight pounds have been found. It is esculent, wholesome, and nutritious, and in some parts of Europe is greatly liked. The taste resembles that of the mushroom. The best mode of cooking it is by broiling. (*See* FUNGI.)

FITCHET. (*See* POLECAT.)

FITS, the popular name of convulsions, or syncope, or sudden attacks of paralysis. Some etymologists suggest that the word is derived from "fights," or conflicts between disease and nature.

FIXED AIR, *fiksd* (Fr., *fixer*, to fix), an old term for carbonic acid applied by Dr. Black, who first observed the evolution, by the action of heat, of carbonic acid from the solid substance carbonate of magnesia.

FIXED OILS. (*See* OILS.)

FIXED STARS, the common name given to all stars in the heavens, with the exception of the planets. They are so called because they appear to us to be stationary in the broad field of the heavens, having no apparent motion, and always preserving the same relative position with regard to each other. They are supposed to be the centres or suns of other systems, similar to our own. Sirius, the dog-star, in the constellation Canis Major, which is the brightest of all the stars, is considered to be nearer the earth than any other; and the distance of this from our planet is computed to be not less than nineteen millions of millions of miles. The fixed stars have been grouped into separate clusters called constellations, and divided into six classes according to their respective apparent magnitudes, the largest and brightest being called stars of the first magnitude, those that are next in size and lustre stars of the second magnitude, and so on. Stars of the sixth magnitude are the smallest that are visible without the aid of a telescope.

FLACOURTIACEÆ, *fla-koor-te-ai'-se-e*, named after M. de Flacourt, a director of the French East-India Company. (*See* BIXACEÆ.)

FLAG, a general term for a number of endogenous plants, the leaves of which are sword-shaped. (*See* ACORUS and IRIS.)

FLAG-STONE, the name given to a rock, generally of sandstone, mixed with argillaceous or calcareous matter, which splits into tabular masses, or "flags," suitable for paving, the construction of cisterns, and similar purposes. The best flags come from North Wales, Yorkshire, and Caithness in Scotland.

FLAKES, *flaiks* (Ang.-Sax.), a layer or stratum in carnations with large stripes of colour. (*See* DIANTHUS.)

FLAME, *flaim* (Fr., *flamme*).—Flame may be defined as a shell of incandescent matter surrounding a mass of combustible vapour. To produce flame it is therefore necessary that the burning body should be capable of volatilization just below the temperature at which it undergoes combustion. A piece of wood or paper burns with a large luminous flame, in consequence of the combustible matter of which it is composed rising in vapour or becoming converted into mixed gases at the temperature required for kindling the substance. Flame is, in fact, produced whenever a continuous supply of inflammable vapour or gas is made to combine with a supporter of combustion, such as the atmosphere, at a sufficiently elevated temperature to cause ignition. The heating power of a flame is in direct proportion to the energy of the chemical action that takes place, those flames being hottest and least luminous which proceed from gases containing no solid particles, as in the case of a mixture of oxygen and hydrogen in the proportion necessary to form water, which is one of the hottest flames we have at our command. The most luminous flames are from gases which contain just sufficient solid matter to give the maximum of incandescence without any of its particles passing away unburnt. The flames used for illuminating purposes are all produced by the combustion of compounds containing carbon and hydrogen. The flame of an ordinary candle is a good illustration of the phenomena of flame. At the lower, or blue portion, the hydrocarbon contained in the gases resulting from the decomposition of the tallow by heat, mixed with so much atmospheric air that the whole of the carbon unites with hydrogen, none being left to give incandescence. Passing higher up, we see a dark part, which consists entirely of the gaseous matter formed by the decomposed tallow. This, on being heated by the blue portion of the flame, rises in luminous vapour until it comes in contact with the oxygen of the atmosphere, when it unites with it, forming a bright but not luminous envelope to the incandescent carbon—the products of the combustion being water and carbonic acid.

FLAMINGO, *fla-min'-go* (Sp.-Port., *flamenco*), a genus of birds (*Phœnicopterus*), generally ranked among the *Palmipedes*. This bird inhabits the warm climates of Asia, Africa, and America, and is one of the most remarkable of aquatic birds. Its height is about four feet. In its first year it is of one colour—greyish white; in its second year, the white is purer and the wings are tinted rose-colour; in the third year it attains its full plumage—wings roseate, back deep scarlet, and quill-feathers jet black; and as the bird grows older, these colours increase in tone. The neck is slender and of great length, equalling that of the legs, which are about two feet. The head is small and round, and furnished with a bill nearly seven inches long, which is higher than it is wide, light, and hollow, having a membrane at the base, and suddenly curved downwards from the middle, as if broken. The lower mandible, which is the larger, is so adjusted as to fit the angle with its edges, its under surface being greatly arched downwards. The edges of both mandibles are serrated. In operation, these mandibles act like a strainer, allowing the water to escape, but retaining any sort of prey the flamingo may capture. Its food consists of small fish and water insects, which it fishes up by means of its long neck, turning its head in such a manner as to take advantage of the crook in its beak. In searching among the mud at the bottom of the water for food, the upper, not the under, mandible is applied to the ground. In that situation the inferior mandible is uppermost, and by its motion works the disturbed water through the two. The flamingo's mode of incubation is peculiar. The great length of its legs, combined with the fact that the bird never sits down, but rests standing on one leg, renders a nest of the ordinary construction altogether unsuitable; so the flamingo constructs a tallish cone of mud, with a cavity at the top, and in this cavity the eggs are laid, and straddles across the whole, so that her feet rest on the ground and the under part of her body on her eggs. The latter are white, and rather larger than those of the goose.

FLATULENCY, *flat'-u-len-se* (Lat., *flatus*, a blast), a morbid collection of gases in the stomach and bowels, commonly arising from indigestion, or from indulgence in certain kinds of vegetable food. For its cure, carminatives, tonics, and aperients are resorted to; and strict attention to diet is necessary, taking only such food as is light and easy of digestion, and avoiding certain vegetables, as peas, beans, and flatulent fruits. Weak brandy-and-water, as a beverage at dinner, is also very beneficial. When the pain is excessive, hot applications to the stomach and friction will frequently afford considerable relief.

FLAX, *flaks* (Sax., *fleax, flex*), the fibre of the *Linum usitatissimum*, separated from the woody portion of the plant, and ridded of any impurities, after which it is spun into thread, from which state it is woven into linen. (*See* LINEN.) It is supposed to be the fruit of Egyptian discovery, as the coverings of the mummies found in the pyramids all attest to their being composed of what is generally termed flax. The flax-plant is of slender form and of annual growth. It reaches generally the height of from two to three feet, and has small lanceolate leaves, which terminate at the extremities in delicate blue flowers, which are afterwards replaced by seed vessels, containing each ten seeds. (*See* LINSEED.) The plant itself grows over the whole extent of Europe, Asia, and America.

FLAX, NEW ZEALAND.—A fibre yielded by *Phormium tenax*, a perennial plant growing in New Zealand and Norfolk Island. The leaves from which the flax are obtained are, in some instances, from five to six feet in length, and about three inches wide. The fibre is very fine and strong.

FLEA, *fle* (Anglo-Sax.).—The proper position of this insect in entomological classification has been the subject of much dispute; but naturalists now generally consider it as belonging to a distinct order, known as *Suctoria, Siphonaptera*, or *Aphaniptera*. The most familiar species is the common flea (*Pulex irritans*), which is very unpleasantly numerous in this country. The body of the flea is protected by a horny covering, composed of segments, which are very well defined—those of the thorax are always disunited. Its mouth is suctorial, formed of three pieces, inclosed by two articulated laminæ, which, when united, form a cylindrical or conical proboscis, the base of which is protected by two scales. Although, to all appearance, apterous, the flea possesses the rudiments of wings, which are four in number, in the form of horny plates on the sides of the meso- and meta-thoracic segments, the hindmost pair being somewhat larger than the other. Its head is small and compressed, on each side of which is a small round eye. The most singular organs of the flea are the two fine-pointed mandibles of the mouth, which, in combination with another sharp organ, constitute the powerful attacking instrument of the insect. The *antennæ* are very minute, and concealed beneath a rake-like plate on the sides of the head behind the eyes. The legs are very strong, more particularly the hinder ones, which are used by the flea in its extraordinary leaps. This insect undergoes a complete metamorphosis; the larva is an elongated footless grub. On arriving at the pupa state, which occupies about twelve days, it incloses itself in a silken cover, and in a few days assumes its mature condition. Besides *Pulex irritans*, there are several other species peculiar to different animals. The dog possesses such a parasite (*P. Canis*); also the martin (*P. Hirundinis*); the mouse (*P. Musculi*); and the mole-flea, a large variety (*P. Talpæ*). They are very intelligent, and, minute as they are, have been trained to perform tricks. There have been several exhibitions of "industrious fleas."

FLEABANE.—A genus of plants (*Pulicariæ*), belonging to the natural order *Corymbiferæ*. Two species are known in England, in moist places, standing about a foot high. The flowers are yellow. The peculiar odour is said to be efficacious in driving away fleas. One of the species, *P. dysenterica*, is reputed to be of great value as a cure for diarrhœa and dysentery. The name fleabane is also given to the Conyza. (*See* CONYZA.)

FLESH, *flesh* (Sax., *flæc*), a compound substance, constituting a large portion of every animal; consisting of the softer solids, as distinguished from the bones and fluids. As a general appellation, it may be taken to include the blood-vessels, nerves, cellular tissue, &c. (*See* MUSCLE, TISSUE.) Chemically considered, flesh consists of fibrin in a coagulated form, permeated by at least three times its weight of water and fluid, consisting partly of blood and partly of substances secreted from it. The soluble matters consist chiefly of albumen, the soluble salts of the blood, two animal principles, called kreatine and urorite, and phosphoric, lactic, butyric, acetic, and formic acids. The salts consist of the phosphate of potash, magnesia, and lime, and a small quantity of chloride of sodium.

FLESH-FLY, belongs to the general order of *Diptera* in the classification of the insect tribe, and the name by which it is distinguished in this order is *Musca vomitoria*, in contrast to the common house-fly, or *Musca domestica*. The insect is termed *flesh-fly*, from the fact of its depositing its eggs in fleshy viands, in which the larvæ are hatched. It is also commonly known as the Blue-bottle. It is generally larger than the common house-fly, and its wings indeed are sometimes nearly three-quarters of an inch in expanse. A nearly-allied species (*M. Cæsar*) is of a golden green colour, and is common in this country. Another species (*M. lardaria*), most common at the end of autumn, and frequenting ivy bushes and late flowers, has black stripes on the crown and thorax.

FLEXIBILITY, *fleks-e-bil'-e-te* (Lat., *flectere*, to bend), a property which all bodies possess to a greater or less degree, which is evinced in their disposition to yield or change their form in a direction at right angles to their length, through their own weight or by means of any pressure or strain applied to them. There is no material that will not exhibit flexibility in some degree, because there is no substance in nature that is perfectly rigid and inflexible; but the degree of flexibility possessed by any material is denoted by the extent to which it will bend, or by the weight which it will support without breaking. This property must not be confounded with that of elasticity; elastic bodies will return to their former shape when they have been bent or altered by pressure in any way; but bodies which possess flexibility without elasticity do not return to their original form in all cases. (*See* MATERIALS, STRENGTH OF.)

FLEXOR, *flek'-sor* (Lat., *flecto*, I bend), the name of certain muscles the office of which is to bend the parts into which they are inserted. The antagonistic muscles are termed extensors.

FLIES, SPANISH. (*See* CANTHARIS.)

FLINT, *flint* (Ang.-Sax.), a mineral composed almost entirely of silica, with traces of iron, clay, and lime. The formation of flint has long been a disputed question amongst geologists: the dialytic discoveries of Graham and Church throw great light on the matter. If a solution of silica be prepared by dialysis, and poured into a vessel containing a very minute quantity of carbonate of lime, the whole becomes rapidly pectised, assuming the gelatinous form in a few minutes. From this it will be easily seen what would happen if a lake or river, containing a notable quantity of silica in solution, were to suddenly flood a chalk plateau. Some writers suppose that the silex was secreted from the sea-water by diatoms and sponges, and their remains most probably supplied the material of the flint. Flint is of great importance as an economic product, being largely used, when calcined and ground, in the manufacture of china, porcelain, and glass. In parts of the country where flints are plentiful, it is much used as a building material, with excellent artistic effect.

FLINTY STATE.—An impure quartz, assuming a slaty structure, and containing about 75 per cent. of silica, the remainder being lime, magnesia, and oxide of iron. There are beds in many parts of Scotland.

FLOAT-STONE, *flote'-stone*, a porous, soft, and friable mineral, consisting of silica, alumina, and carbonate of lime. From containing numerous pores, it holds a large quantity of air, and swims on water until it is saturated; hence its name.

FLORA, *flo'-ra*.—A collective name for vegetable productions. Scientific writers speak of the Flora of a particular country when describing its trees, flowers, and productions of the vegetable kingdom.

FLOUNDER, *flown'-der* (Swed., *flundra*), (*Pleuronectes flexus*), a flat fish very similar to the plaice, but smaller, and of more obscure colour. It is very common about the British coast, and is found in the Northern, Baltic, and Mediterranean seas. Its body is covered with very small scales, and along its back runs a row of sharp spines.

FLOWER, *flow'-er* (Fr., *fleur*), that portion of a plant which is formed by the union of all the organs which contribute to the formation of the seed. In common language, the word is used to convey the idea of the portion in which the gayest colours are found. A complete flower consists of the essential organs of reproduction, inclosed in two particular envelopes which protect them. These essential organs are called the *pistils* and *stamens*. The floral envelopes are termed *calyx* and *corolla*. The extremity of the peduncle, or pedicel upon which the parts of the flower are placed, is called the *thalamus* or *receptacle*. (*See* various headings.)

FLOWERING PLANTS. (*See* PHANEROGAMIA.)

FLOWERLESS PLANTS. (*See* CRYPTOGAMIA.)

FLUID, *flu'-id* (Lat., *fluidus*, from *fluo*, I flow), is defined to be that whose component parts or particles yield to the slightest pressure, and are moved or disseminated amongst each other without any apparent sensible resistance. Some writers on scientific subjects distinguish between fluids and liquids. All liquids are fluids; but it does not necessarily follow that all fluids are liquids; for air, ether, mercury, water, and alcohol, are all fluids; but water and alcohol are also liquids, because they wet, or create moisture on bodies, which mercury and air do not do. Fluids are of two distinctive kinds—elastic and non-elastic; the former are comprised under the general term Pneumatics, and include all airs and gases; while the latter, which only include water and other aqueous fluids, are comprised under the general head of Hydrostatics and Hydraulics. (*See* those headings.) The terms *elastic* and *non-elastic* are only used here in a relative sense, and not absolutely, as all fluids are elastic more or less, water being compressible, although offering resistance.

FLUKE, OR FLUKEWORM.—An entozoom (*Distoma hepaticum*) common in the liver and filiary ducts of ruminant animals, especially sheep, producing the disease known as "rot." It is generally about an inch in length and of an oval form. Instances have been known of the appearance of the fluke in the human liver.

FLUORESCENCE, *fluo-res'-sens*.—A blue appearance exhibited by certain substances, especially solutions of sulphate of quinine, when exposed to sunlight.

FLUORESCENT RAYS, *flu-o-res'-ent raiz*, certain rays which exist beyond the blue end of the spectrum, invisible under certain circumstances. (*See* SPECTRUM.)

FLUORIC ACID, *flu-or'-ik*. (*See* HYDROFLUORIC ACID.)

FLUORINE, *flu'-or-ine*.—An elementary substance allied to chlorine. Many unsuccessful attempts have been made to isolate this body. Several chemists have succeeded in obtaining an impure form of it by using vessels of fluor spar, but its properties have never been satisfactorily determined. Its principal compounds are fluoride of calcium, or fluor spar, and hydrofluoric acid. It also combines with most of the metals; also with boron, silicon, sulphur, silenium, and phosphorus. It exhibits no tendency to unite with oxygen. It is found somewhat sparingly in the mineral kingdom, in fluor spar, epatite, topaz, and a few other minerals. It also exists in the ashes of sea-plants, in sea-water, and in blood, milk, and the human teeth. With boron and silicon it forms two compounds, which are absorbed by water, giving rise, respectively, to fluoboric and fluosilicic acids.

FLUOR SPAR, *flu'-or spar*, a mineral of great beauty, found in different parts of the world, but principally at Castleton, in Derbyshire, Aston Moor, in Cumberland, and in Cornwall. It occurs in cubes and octahedra and concretionary masses, being most commonly of a violet-blue colour, but also yellow, green, purplish-red, and red. In its rougher forms it is often used as a flux, and the finer specimens are fashioned into cups and vases, under the name of Derbyshire spar, or, locally, Blue John. It consists, chemically, of fluoride of calcium.

FLUSTRA, *flus'-tra* (Sax., *flustrian*, to weave).—A genus of Zoophytes, of the class *Polyzoa*, some species of which are common on the shores of the British Isles. They have a mat-like structure, and are commonly mistaken for vegetable productions, some resembling a branching frond; but they are, when disturbed, active in their movements. A single specimen has been found to contain about 18,000 polyp heads.

FLUX, *fluks* (Lat., *fluxus*, from *fluo*, I flow), any preternatural fluid evacuation from the body, but more especially those that proceed from the bowels. It is frequently applied to diarrhœa, and dysentery was long known as the bloody flux. (*See* DIARRHŒA, DYSENTERY.)

FLUXIONS, *fluk'-shuns* (from Lat., *fluo*, I flow).—The more common appellations by which the theory of fluxions is known to the general reader or mathematical student, are the differential or integral calculus. The calculus of fluxions, which is one of the most important additions ever made to the abstract mathematical sciences, was invented about the middle of the 17th century. The theory of fluxions, or calculation of the velocity in uniform or variable motion, necessarily depends on that higher system of trigonometry which treats on drawing tangents to curves. The facility which this new motion of velocity gave to the extension of geometry, induced various foreign mathematicians, as Descartes, Roberval, and Fermat, to employ it in their researches. So very near did the last-mentioned approach to the true theory of the fluxional or differential calculus, that Laplace says he ought to be reputed its inventor. To find the real discoverer, however, we must look to two men, Newton and Leibnitz, for each of whom the honour of its invention is claimed. Newton certainly promulgated and published his method the first, in the year 1665. The principles of his theory may be thus described:—1. Supposing two quantities to have a given relation to each other (for example, the one to be always equal to the square of the other), and the rate of increase of one of them at any instant of time to be known: to find the rate of increase of the other at the same instant. These rates of increase were called the *fluxions* of its quantities; and the rules for their determination constituted the *direct method of fluxions*, or *differential calculus*. 2. The second part of this theory was exactly the reverse of the first; it is a problem in which the relations between the rates of increase of two quantities, which depended the one on the other, being given, it was required to discover the relation of the quantities. This was the inverse method, or *integral calculus*. According to Newton's theory, a plane, curve, or line, may be conceived as generated by a point moving uniformly in the direction of some fixed line, and having at the same time a lateral motion with respect to this line, which is governed by some law dependent upon the nature of the curve generated. The part of the curve which is generated at any instant of time is called the *fluent*, and that infinitely small element generated during the next infinitely small and constant period of time is called its *fluxion*. If, in addition to the two motions already explained, we conceive the point to have a third motion at right angles to the plane of the other two, and also regulated by a law which must depend upon the nature of the curve, the generating point will describe a curve in space, which may be either a plane-curve, or one of double curvature. It may be thus easily surmised that by suitably regulating the laws of motion of the generating point, any curve whatever may be described; it is also obvious from the theorem laid down, that, by the law of relation between the fluxions of the elements, the nature of the curve may be easily discovered. In the general deductions of mathematical science, if we suppose any line, which may vary according to some law, to move according to any fixed law, it will generate a surface, and the portion generated during any infinitely small portion of time will be the fluxion of the surface, while the whole portion generated will be the fluent. In a consequent manner, if a plain area move in any direction, the area being supposed to vary by a fixed law, then will the infinitely small volume generated in an infinitely small portion of time be the fluxion of the solid, and the portion generated will be the fluent. In this system, any magnitude may be regarded as flowing ultimately from a point; a point in its motion may generate any line; a line in its motion may be made to generate any surface; and, lastly, a surface may generate any volume. The notation of fluxions has been found to be their drawback, and the main superiority of differentials and integrals over them is due to that.

FLY, *fli* (Sax., *fleoge*), a name applied almost indiscriminately to all insects possessing wings; by many, however, restricted to the various species of dipterous insects. The legs of this class of insects are long and slender; and the feet, it is well-known, are furnished with skinny palms, to enable them to stick on glass and other smooth bodies by means of the pressure of the atmosphere.

FLY-CATCHERS, *fli-katsh'-erz* (*Muscicapidæ*).—This very numerous family of birds is widely diffused throughout both the eastern and western continents. As their name implies, they prey on insects, which they seize in mid-air. They have the beak horizontally depressed, and armed with bristles at its base, with the point more or less decurved and emarginated. One of the best types of fly-catchers is that presented by the tyrant fly-catcher (*Muscicapa Tyrannus*). A bird peculiar to America. It is eight inches in length, and fourteen in extent of wing. The general colour of the upper parts is dark bluish-grey, inclining to dull slate-black on the head, of which the central feathers along the crown form a gorgeous orange patch. It builds its nest on branches of trees; it is a rather bulky structure, composed of twigs and wool, or tow and cotton, and is very thick and snug. No matter the species of bird, on matter its size or strength, it is sufficient that it approaches any way near the tyrant's nest to excite his jealous rage, and out he sallies bent on instant satisfaction. It is said that eagles and hawks may not with impunity approach this bird's nest, made sacred by his fledglings, and that, darting up into the air, it will launch down on to the back of its enemy, and there anchor in such a way as to make it a difficult matter to dislodge him. Only two small species of this tribe are found in this country. The spotted and the pied fly-catchers, about the size of sparrows. The European species are distinguished from any other by having much more slender bills, with shorter bristles at the gape.

FLY, DRAGON. (*See* DRAGON FLY.)

FLYING, *fli'-ing* (Sax., *fleogan*, to fly), the power which many animals possess of raising themselves in the air, and in moving through it in various directions, supported by the atmosphere alone. (*See* WING.)

FLYING DRAGON. (*See* DRAGON.)

FLYING-FISH (*Exocœtus*), a genus of fishes that, on account of the extraordinary length and size of their pectoral fins, are enabled to spring from the water and support a kind of temporary flight through the air. They belong to the *Scombersocidæ* family. Their distinguishing features are—pectoral fins nearly equal to the body in length; head flattened above and on the sides; the lower part of the body furnished with a longitudinal series of carinated scales on each side; dorsal fin placed above the anal; eyes large; jaws furnished with small pointed teeth. Although some few naturalists have supposed that these fish possess the true power of flying, that is, by beating the air with their members, it is generally agreed that their large fins sustain them, parachute-wise, when they have leaped from the water. They will rise sometimes to the height of twenty feet from the water, and not unfrequently fall on the decks of ships. They swim in shoals, and large numbers will rise at the same time. Several instances are on record of the appearance of flying-fishes off the British coast, but the species is doubtful. It is probable that both the oceanic flying-fish (*Exocœtus volitans*) and the Mediterranean flying-fish (*Exocœtus exiliens*) may have made their appearance in our seas. In the Gulf of Mexico are found some species with curious appendages or filaments attached to the lower jaw. The natives of the South Sea Islands catch them for food. The *Flying Gurnard*, a member of the family *Sclerogenidæ*, has also the power of taking long leaps and supporting itself for a time in the air. It differs from the fish described above in the appearance of the pectoral fins.

FLYING FOX. (*See* BAT and KALONG.)

FLYING LEMUR, OR COLUGO (*Galeopithecus volans*).—This is another curious species of mammalia which possesses the power of flying or leaping considerable distances, by means of a membrane connecting its limbs with each other. The flying lemur forms the connecting link between the *Quadrumana* and the *Cheiroptera*; to the latter, indeed, it has a great resemblance, insomuch as many naturalists of eminence have placed it in that order. It differs, however, from the bats in many respects, not the least important deviation of which is the absence of opposable thumbs on all the feet, which are composed of five fingers united by a membrane. Notwithstanding this, it certainly bears, in its appearance and habits, a remarkable similarity to the flying-fox. In its diet, it is both carnivorous and frugivorous; feeding on birds and their eggs, insects, and fruits. It is found in the Indian Archipelago, living in the forests; seeking by night for its food, and remaining in a dormant state during the day.

FLYING SQUID.—A genus of cephalopodous molluscs, differing from the true squid in the construction of the fins and the tail. They have the power of leaping out of the water to a height of 15 or 20 feet. They are used in Newfoundland as bait for cod.

FLYING SQUIRREL.—By this name are known several species of squirrels, the more important being the Taguan flying squirrel (*Pteromys alpinus*), which is a native of India, where it is tolerably abundant. It has derived its name from a parachute-like appendage, consisting of a broad fold of skin, stretching along each side of the animal, from the fore to the hind legs; and when it intends making a leap, it expands this curious membrane to the fullest extent, and is thereby enabled to jump a considerable distance, although always downwards, which, in fact, its so-called "flying" properties are limited to. It measures about three feet in length, of which its tail occupies more than half. Its general colour is chestnut, deepening into brown on the back and red on the sides; the abdomen, throat, and breast are covered with silvery greyish-white fur. The tail is greyish-black, becoming much darker towards its extremity. The assapan, or flying squirrel of America (*Sciuropterus volucella*) is another variety, agreeing with the above in its leading characteristics. The name is also commonly given to the Flying Phalanger (*Petaurus Taguanoides*), a marsupial quadped, native of Australia and New Guinea. One of the Australian species is scarcely larger than a mouse.

FOCUS, *fo-kus'* (Lat., *focus*, a hearth).—When light is reflected from regular curved concave surfaces so that all the rays converge to one point, that point is called the focus. The same term is applied to that point towards which rays of light converge after passing through a refracting medium, such as a lens. A telescope, or other optical instrument, is said to be in focus when the arrangement of lenses is such that the object examined falls clearly and distinctly upon the retina of the observer. In the reflection of heat, the point to which the rays converge is also called the focus. In Geometry and conic sections, the term focus is applied to certain points in the parabola, ellipsis, and hyperbola, where the rays reflected from all these curves converge and meet.

FŒTUS, *fe'-tus* (Lat., from *feo*, I bring forth), a term applied to the child in the uterus from the fifth month of pregnancy to the time of birth. Previous to that time, it is commonly called the *embryo*; but these terms are rather arbitrary, and the one is frequently used for the other. (*See* PHYSIOLOGY.)

FŒNICULUM, *fe-nik'-u-lum* (from Lat., *fœnus*), the Fennel, a genus of the natural order *Umbelliferæ*, formerly placed under *Anethum*. Two species, namely, *F. vulgare*, the common fennel, and *F. dulce*, the sweet fennel, are much used in this country as pot-herbs, and for garnishing dishes. The former grows wild on rocks and walls, particularly near the sea: the latter is frequently regarded as a cultivated variety of the same plant. *F. Capensis* is a common esculent at the Cape of Good Hope. The term is derived from the Latin word for usury, because the seed yields, or is returned with, great increase.

FOG. (*See* MIST.)

FOLIATION, *fo-li-a'-shun.*—A term applied by geologists to the alternating layers or plates of different mineralogical nature, of which gneiss and metamorphic schists are composed.

FOLLICLE, *fol'-le-kl* (Lat., *folliculus*), a superior one-celled, one or many-seeded fruit, and one-valved. By the latter character it is known at once from the legume, which opens by two sutures, and is two-valved. The columbine, larkspur, hellebore, and aconite are examples.

FOMENTATION, *fo-men-tai'-shun* (Lat., *fomentatio*, from *foveo*, I bathe), the application of heat and moisture to a part, by means of flannel or other substance wrung out of hot water, in order to relieve pain or to stimulate the surface.

FOOD AND DRINK, *food* (Sax., *foda*, food and drink).—Those solid and liquid substances which are used either for sustaining animal life or for the purpose of reproducing the ever-wasting tissues and fluids of animal bodies. Of the elementary bodies, only a small proportion enter into the constitution of animals; and the substances included in this small proportion are the only ones required to be present in food and drink. Out of about sixty elements, only oxygen, hydrogen, nitrogen, carbon, sulphur, phosphorus, chlorine, sodium, potassium, calcium, magnesium, iron, and fluorine, are absolutely necessary. Albumen, fibrine, and caseine, which occur both in animals and vegetables, together with vegetable gluten, furnish oxygen, hydrogen, nitrogen, and carbon. Animal flesh, eggs, milk, corn, and various other vegetable productions, contain one or more of these principles. Food containing a large proportion either of sugar, starch, or organic acids, introduces carbon, hydrogen, and oxygen largely into the system. Oleaginous alimentary substances contain carbon with a little oxygen and hydrogen: this class of substances includes fat, suet, butter; oily seeds, such as nuts; and fatty foods, such as liver, &c. Flesh, blood, and bones, used as food, supply phosphorus to the system; the flesh of fishes is particularly rich in phosphorus; and in the shape of phosphates, it exists in the juices of many edible vegetables. Sulphur is introduced into the system from the fibrine of flesh, from albumen, from the caseine of milk, gluten, &c. Chlorine and sodium exist in nearly every variety of animal food, and, in the shape of common salt, are taken separately with nearly all kinds of food. Potassium is found in various kinds of food, both animal and vegetable; in milk, in the juice of flesh, and in nearly all inland plants. Calcium is not only obtained from animal and vegetable food, but also from drinking-water, which usually contains sulphate and carbonate of lime in solution. Magnesium is generally found along with calcium, and traces of fluorine have been observed in milk, blood, &c. These simple bodies are, however, not capable of being directly assimilated and converted into tissue; they must be previously in combination; and their assimilation depends upon certain chemical decompositions and physiological processes. Baron Liebig, who has given much attention to this subject, has divided all kinds of food into two classes—those substances which do contain nitrogen and those which do not. The first class, which is sometimes called nitrogenous or albuminous, is useful in forming blood, flesh, &c.; it is, in fact, nutritious food. The second, or non-nitrogenous class, assists the respiratory organs. Thus, in very cold climates, where more exercise is required in order to sustain the vital heat, more oxygen is consumed, and consequently more carbon is required in the food. In the temperate zone, a moderate mixture of nitrogenous and non-nitrogenous food is used; while, in the tropics, where the system requires oxygen in particular, fruits and vegetables form the principal food. All kinds of flesh are not equal with regard to their nutritive value. Veal, for instance, is totally different from beef. It contains a smaller quantity of the alkalies, and there is 15 per cent. more phosphoric acid than is necessary for the formation of salts; it contains, also, little of the fibrine of flesh, and proportionately more of the fibrine of blood, which is less digestible than the former. Veal is rich in gelatine, which is not nutritious, and seldom contains any quantity of fat: it also contains very little iron. In all these points it is the reverse of beef. Hard-boiled eggs have little or no nutritive power, and the same may be said of boiled fish, the soup of which is generally thrown away. In order to make up the necessary deficiency of nutritive matter in veal, eggs, and fish, vegetables should be taken with them. Celery contains 18 per cent., salad 24 per cent., and cabbage-sprouts 10 per cent., of their dry weight of salts, alkalies, and alkaline earths. Vegetable food in general contains a large proportion of iron. In the human body, iron is present in the blood, the bile, and other places. Prolonged absence from fruits and succulent vegetables brings on scurvy. The absence of the acids which they contain produces this effect: thus lime-juice is used by sailors with good effect on long journeys. Amongst the condiments used for flavouring food, are mustard, cayenne pepper, black pepper, and various spices. They owe their action to the presence of a volatile oil. The volatile oils of fennel, thyme, parsley, anise, caraway, horseradish, mustard, and water-cress stimulate the system, but do not not incorporate themselves. Condiments and sauces (which are usually fluid mixtures of condiments), in time, generally weaken the organs, which they at first stimulate. The only exceptions are salt and vinegar. Drinks for the most part are simply liquid food. They may be divided into the following classes:—1. Mucilaginous, farinaceous, or saccharine drinks; such as barley-water, *eau sucré*, &c. They are a little more nutritive than drinking-water. 2. Aromatic or stringent drinks; such as tea, coffee, chocolate, cocoa, &c. They all contain principles which act with a slightly exhilarating action upon the nervous system: chocolate and cocoa contain oil and starch. 3. Acidulous drinks; such as lemonade, ginger beer, raspberry vinegar, &c. They allay thirst, and form cooling antiscorbutic drinks. 4. Drinks containing gelatine and ozmazome, including broths and soups. These, when properly made, ought to contain all the soluble constituents of the substance from which they are prepared. 5. Emulsive or milky drinks; such as animal milk, cocoa-nut milk, almond milk, &c. Animal milk contains all the essential ingredients of food; the others are slightly nutritive. 6. Alcoholic and other intoxicating drinks, including malt liquor or beer, wines and spirits.

FONTINALIS, *fon-ti-nai'-lis*, a genus of mosses, in many respects similar to *Hypnum*, but having the fruit enveloped in the leaves, and almost without stalk. The water-moss (*F. antipyretica*) is a well-known British specimen, which takes its name from its ability to resist fire, on which account it is used in some parts of the North of England as a lining for chimneys. The shoots are about a foot high. It grows upon rocks and the roots of trees in moist situations.

FOOLS' PARSLEY. (*See* ÆTHUSA.)

FOOT, *foot* (Ger., *fuss;* Lat., *pes*), that part of the lower extremity below the leg with which we stand and walk. It is composed of three series or groups of bones—the tarsal, or hindermost; the metatarsal, which occupy the middle portion; and the phalanges, which go to form the toes. The movements of the foot, which are permitted by the connecting ligaments, are effected by a variety of muscles. (*See* ANATOMY.) The foot, naturally a beautiful structure, is usually so much interfered with in civilized life as to be deprived of much of its beauty, and even of its utility. Its movements are impeded by its being confined in tight-fitting boots; while, in place of the boots being conformed to the shape of the feet, the feet are made to conform to the shape of the boots; the consequences of which are corns, bunions, cold feet, and a number of other evils, from which so many suffer in the present day.

FORAMEN, *for'-a-men* (Lat., an orifice), a term applied to certain holes or openings of the human body, more particularly of the skeleton; as the various foramina of the skull. The *foramen ovale* is a passage or communication between the two auricles of the heart in the fœtus.

FORAMINIFERA, *fo-ra-me-nif'-e-ra*, a group of minute organisms having calcareous shells, which are pierced with numerous holes or foramina. They are now looked upon as protozoa. The pores are for the protrusion of delicate filaments, by the aid of which locomotion and perhaps nutrition are performed. Recent *Foraminifera* are beautiful microscopic objects; they are procured by dredging, or sometimes from the sand of the sea-shore. In the fossil state these tiny shells occur in rocks of all formations; they constitute the greater bulk of the chalk and the tertiary limestones.

FORBIDDEN FRUIT. (*See* CITRUS.)

FORCE, FORCES, *fors* (Fr.).—In Mechanics, force is a term applied to any cause which is capable of producing motion in matter, or of stopping or altering its direction when produced. Every visible particle of matter is under the influence of several forces, exerted upon it both by distant and by adjacent particles, and upon which it acts in return; for the action of one body on another is always accompanied by a re-action of the latter upon the former, of the same intensity, in an opposite direction. The motions observed in some bodies are owing to these forces, and upon their balance the apparent state of rest in others is dependent. Force having its proximate seat in the muscles of man and other animals, it is called muscular or animal force. This force can be communicated to inanimate matter, as when a stone is projected from the hand. Muscular force may also be concentrated in the same mass by continued action, as when a stone, by means of a sling, is continuously acted upon by the same arm, it will at length be projected with an intensity of action capable of producing very violent effects. Force transferred to moving masses of matter is called mechanical force, and by multiplying the quantity of matter in a body by its velocity we arrive at its *momentum*, or the quantity of force which it is capable of exerting upon other bodies opposed to it. The investigation of the laws of motion constitutes the province of Dynamics. In mechanics, the term decomposition of forces signifies the same thing as resolution of forces. Any force may be decomposed or resolved into a number of forces, and the original force will be equal to the resultant of those forces. Some forces cause masses of matter to approach and others to recede from each other, retaining them in their second position against an opposing force: the former are called *forces of attraction*, and the latter of *repulsion;* thus, gravity is a force of attraction, and elasticity a force of repulsion. In electricity and magnetism the forces of attraction and repulsion are also shown. (*See* ELECTRICITY.) Polar forces are those which are conceived to act in opposite directions at the extremities of the axes of molecules or of masses of matter. The forces mentioned above are usually termed *external* forces, for they act upon matter at sensible distances; but there are others which act only upon its constituent molecules at insensible distances: these are frequently called *internal* or *molecular* forces; they include homogeneous attraction or cohesion, the universal antagonist of which is the repulsive force of heat (which *see*). Another attractive force is that of heterogeneous affinity, by which a piece of metal or glass is *wetted* when dipped into water. Heterogeneous attraction is seen in its highest degree in chemical affinity, an inquiry into the laws of which force constitutes the chemist's peculiar province. (*See* AFFINITY.) The correlation of the physical forces is a very important principle in natural philosophy, which has of late years been particularly enunciated by Mr. W. R. Grove. Many philosophers had previously asserted that all the forces of nature were intimately connected, and dependent upon one common principle; but the correlation, or necessary mutual dependence and commutability of each of the physical forces upon and into any other, or into all, and of all, reciprocally into each other, was at its original enunciation the particular theory of Mr. Grove. His doctrine is, "that the various affections of matter which constitute the main objects of experimental physics—namely, heat, light, electricity, magnetism, chemical affinity, and motion, are all correlative, or have a reciprocal dependence; that neither, taken abstractedly, can be said to be the essential cause of the others, but that either may produce or be convertible into any of the others: thus, heat may, mediately or immediately, produce electricity; electricity may produce heat; and so of the rest, each merging itself, as the force it produces becomes developed; and that the same must hold good of other forces, it being an irresistible inference from observed phenomena, that a force cannot originate otherwise than by devolution from some pre-existing force of forces."

FOREST, *for'-est*, a large expanse of ground covered with trees. The word is derived from the Low Lat., *foresta*, which is itself originated by the Ger., *forst*, signifying the same thing. Forests are interesting in many ways, as they may be said to mark the track of civilization, besides being of the utmost utility to man, both from local as well as atmospherical influences. Forests were greatly venerated by the Romans and other ancient peoples, temples being often erected and sacrifices ordained in their honour. This may be considered one of the greatest reasons for the Druids living in them, as it was thought much more sacred to dwell under trees than *en plein champ*—in the open field. Forests abroad are mostly composed of (in Europe) oak, elm, beech, poplar, ash, alder, plane, willow, lime, and birch; not to speak of the numbers of wild apple, pear, and other fruit-trees; besides pine, fir, and cypress in profusion, with all species of bush-wood and vines. In Norway, the forest-land extends up to Drontheim, which is in latitude 63° north. Switzerland is well wooded, and oaks and firs are found at a level over 4,000 feet above the sea. France has some fine examples, her variety of climate being favourable to the growth of all species of trees, some of which, indeed, belong to a much warmer climate: the forest of Ardennes and the Bois de Boulogne may be mentioned as instances of the expanses she has covered with trees. In Italy, the plains of Ravenna afford a wide scope for the luxuriance of forest life, and the pine grows there very extensively; most of the oak, too, used in our navy for shipbuilding purposes, comes from Italy. Russia, however, bears away the palm for her abundance of forests, and some of the finest timber in the world comes from her ports in the Baltic. The districts of Twer and Novgorod are regularly covered with wood and the forest of Volkonsky is thought the largest in Europe. For the largest forests, the reader must look to the New World, where, in both the north and south of America, the vegetation appears to possess no limits. In North America, the forests are gradually disappearing, through the immigration into the country and the diffusion of settlers; but in South America, the whole of the valley of the Amazon, which embraces one-third of the entire area of that country, is one vast forest. It would be impossible to give an account of the various descriptions of trees which are to be found there; for they are apparently without limit, and the size of the individual trees is generally stupendous, and nowhere in the world is there such an abundance of vegetation and of animal life as in the South American forests. The direct influence of forests on climate is a diminution of temperature, which is affected either by screening the soil from the heat of the sun's rays; by the evaporation of moisture from the leaves; or, thirdly, by the uneven surface which the leaves offer to the cooling process of radiation. Cutting down of forests is always followed by a diminution in the rainfall of the district. (*See* RAINFALL.)

Fossil Forests.—The remains of trees are found in the coal measures, and also in the Lower Purbeck and Devonian formations.

FORGET-ME-NOT. (*See* MYOSOTIS.)

FORM, *form* (Lat., *forma*; Fr., *forme*), is the manner and mode in which anything is presented to our ideas of conception. In Physics, the shape and external appearance of a body, the figure of the same as defined by angles or lines, or that manner of presenting itself to the eye peculiar to different bodies, is termed *form*; as, form of a circle; form of a square; the form of the human body; and other instances. Form is likewise to be distinguished from the real apparent nature of things; and if we take it in this light, the idea of form is used in a practical manner in our daily speech and scientific pursuits.

FORMATION, *form-a'-shun*, in Geology, a term applied to a group of strata united by some character which they have in common.

FORMICA, *for-mi'-ka* (Lat.). (*See* ANT.)

FORMULA, *form'-u-la*, in Chemistry, is an expression of the composition of a substance by means of symbols. The formulæ of bodies may be either *empirical* or *rational*. An empirical formula is one giving the elements contained in a body, without reference to their arrangement. For instance, the empirical formula of crystallised sulphate of copper would be CuO_9SH_5, but the rational formula, showing its composition, would be $CuO.SO_3 5aq$.

FORNAX, *for'-naks* (Lat., a small furnace), a constellation of the southern hemisphere, named by Lacaille, and situated in close proximity to Cetus. It contains no stars of the first or second magnitude.

FOSSE, in Anatomy, the term is applied to a large cavity in the bone, with no exit or perforation.

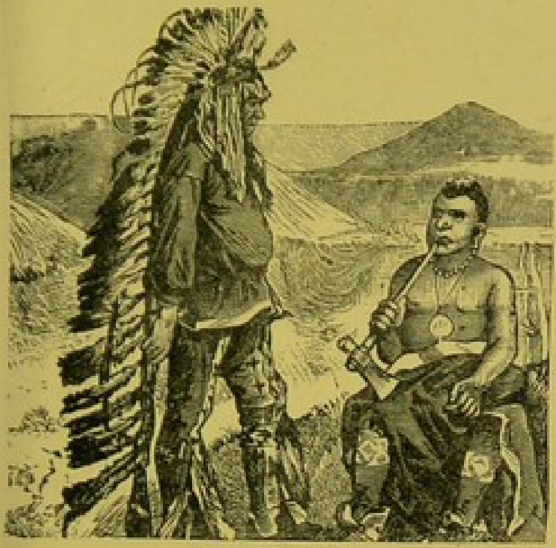
FOSSIL, *fos'-sil* (Lat., *fossilis*, dug up), in Geology, the body, or any portion of the body, of an animal or plant buried in the earth by natural causes, or any recognizable impression or trace of such a body or part of a body. The old geologists used to include minerals, or any other distinct bodies that were found in rocks, under the term of fossils. According to modern views, fossils are simply organic remains, allowing the word "remains" to apply even to foot-prints and other transient impressions. A fossil is not necessarily a petrifaction. Some fossil shells found in comparatively old rocks, such as the soft compact clays of the oolitic series, are less altered from their living state than many shells included in recent coral reefs. Wood, again, may be found in such rocks still soft and but little altered; while in much more recent formations it is entirely mineralized, and converted either into flint or into coal. That department of geology which relates to fossils is termed *Palæontology* (which *see*).

Fossiliferous Rocks, are those which contain organic remains. No fossils have yet been found in the metamorphic rocks.

FOUSIL OIL, *fou'-sil* a substance found in brandies distilled from fermented potatoes, rye, barley, and the marc of grapes. Its chemical name is amylic alcohol, under which heading its properties are described.

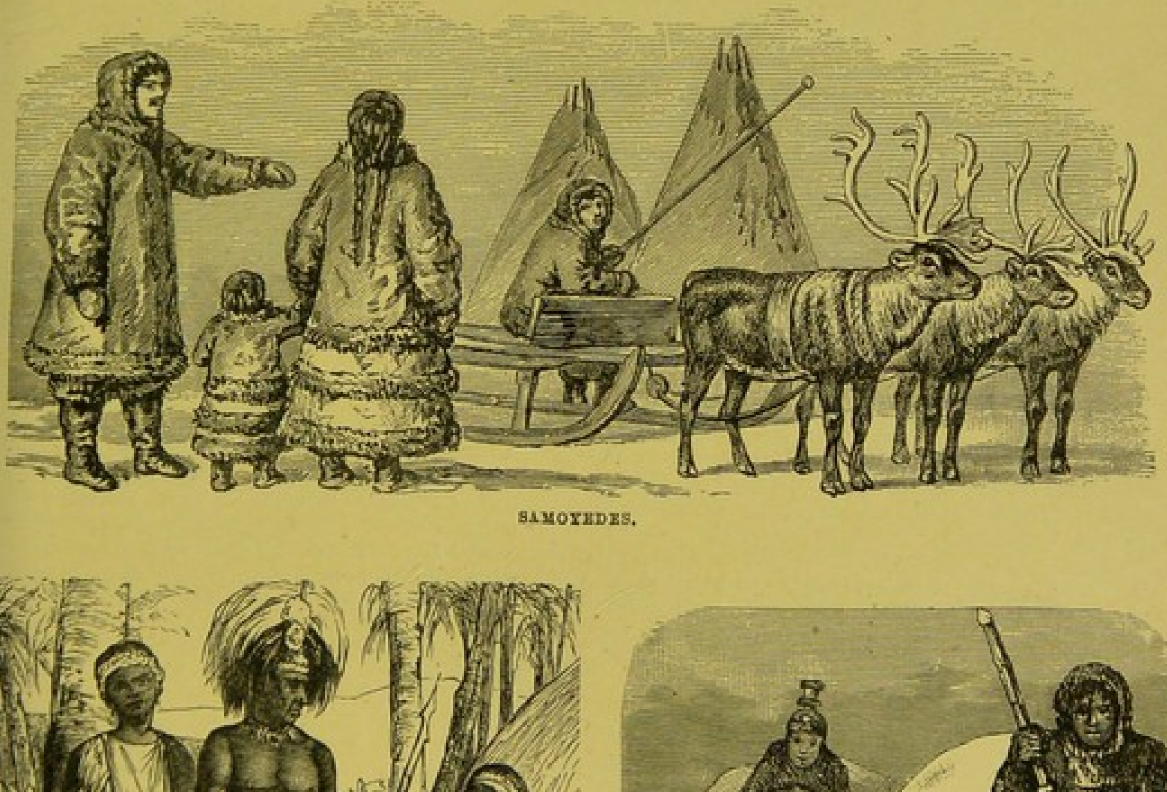
FOVILLA, *fo-vil'-la* (Lat., *foveo*), the matter contained within the membranes of the pollen-grains. It is a semi-fluid granular protoplasm, in which are suspended very minute starch granules, and what appear to be oil globules. It is, without doubt, the essential part of the pollen-grain. (*See* POLLEN.)

FOWL, *fowl* (Sax., *fugel*).—In its general sense, this term is nearly synonymous with *birds*; but in a more restricted sense it means those domestic birds brought up in a farmyard for the table. Fowls originally came from



PAWNEE INDIANS.

HOVAS.



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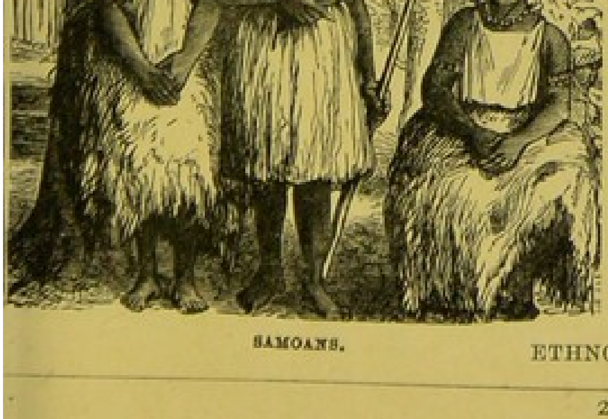

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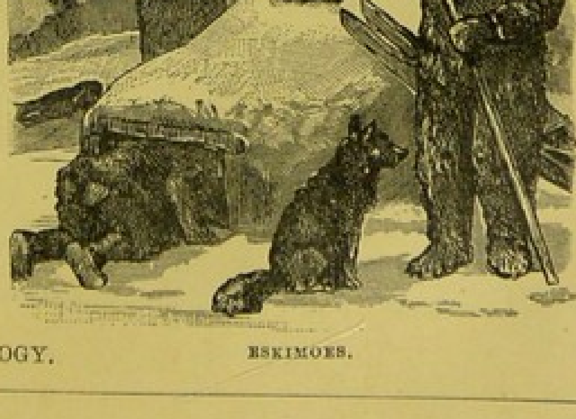


ESKIMOES.

ETHNOLOGY.

Persia and India, and they are valuable to the breeder in many ways, yielding profit as they do in eggs, in broods, and in feathers. The different kinds of this useful domestic creature are the Cochin-China, the Hambro', the Spangled, the Spanish, the Bantam, the Malay, the Poland, the Brahmapootra, and the Dorking. Besides these there are several other scarce specimens; as the Japanese Bantam or Silky Fowl, the Emu or Silky Cochin, the Andalusian, the Rangoon, and the Ancona fowls, all of which are bred more for exhibition than for real utility. The Cochin-China is one of the largest of the different kinds, and the colours of its plumage are buff, lemon, cinnamon, grouse, partridge, white, and black. They are capital layers, and in a short time a pair will stock a yard. The Hambro' fowl is one of the prettiest varieties and has gold and silver plumage; they are also prodigious layers, but rarely have patience to bring up a brood. The Spanish fowl and the Dorking are more commonly seen than the other varieties, and are certainly of more use to the breeder, being good sitters as well as layers. The Bantams are the greatest favourites, being remarkably small birds, and having delicate plumage. It would be impossible to give a description of all the different varieties here.

The Guinea-Fowl, or Pintado, is sometimes classed among the common order of fowls. These birds are very wild and restless in their nature, and, unlike the ordinary fowls, they give no notice to any one of their laying or sitting; they have consequently to be closely watched. As the Guinea-fowl rarely watches over her nest and rears a brood, its eggs are generally put under a common hen. It is very delicate eating.

FOWLER'S SOLUTION. (*See* ARSENIC.)

FOX, *foks* (Ang.-Sax.).—A genus (*vulpes*) of the *Canidæ*, but differing from others of the family in the shape of the pupil of the eye (which is elongated), the bullet head, the bushy tail, the long body, supported on short limbs. The common fox (*Vulpes vulgaris*) is the only species found in this country. Its colour is reddish fawn, intermixed with black and white hairs; its tail, or "brush," is of the same colour, except at the tip, which is white. It measures about two feet and a half in length, and twelve inches in height. Its coat is much heavier and thicker during the winter months, when its fur is of greater value than in warmer weather. The fox emits a most unpleasant scent, which proceeds from certain glands situated at the root of the tail. This powerful odour is rendered more disagreeable from the remarkable tenacity with which it clings to any object which it has once touched. The common fox lives on rabbits, hares, partridges; and, when occasion offers it a chance of obtaining entrance into the farmyard, it often commits great havoc among the poultry. It burrows in the ground like the rabbit; and, indeed, often turns out that animal from its domicile to take up its own abode there. Besides the above species, there are several others: the Persian fox (*V. flavescens*), the American fox (*V. fulvus* and *V. Virginianus*), the South-African fox, or Caama (*V. Caama*), the Senegal fox (*V. dorsalis*), the Kit fox (*V. cenereo-argentatus*), the Kokree (*V. Bengalensis*), the Salora (*V. Niloticus*), and the Arctic fox (*V. lagopus*), white in colour, densely clothed with a woollen fur, gregarious in habits, and without the offensive odour of other foxes.

FOXGLOVE. (*See* DIGITALIS.)

FOX-GRAPES. (*See* VITIS.)

FOXHOUND, *foks'-hownd* (Ang.-Sax.), a species of dog used in the sport of fox-hunting. In the true foxhound, nearly all the individual good qualities which distinguish other varieties of dogs are combined; and, for fleetness, strength, fine scent, spirit, perseverance, and subordination, it has no equal. The foxhound is not a very large animal, its height averaging from twenty to twenty-two inches. The colour is generally pied, such as yellow, black, dun, fallow, and brown intermixed.

FOX SHARK, OR THRESHER.—A genus of sharks (*Alupias*). The only known species, the *A. vulpis*, is found in the Mediterranean and the Atlantic. The upper lobe of the tail fin is nearly equal in length to the whole body, and is used as a weapon of great power. The fox shark is very bold and voracious. The average length, tail included, is about 13 feet.

FOXTAIL GRASS.—A genus of grasses (*Alopecarus*), of which about six species are British. The meadow Foxtail grows nearly two feet high, and is one of the best meadow and pasture grasses, and good for lawns.

FRACTIONS, *frak'-shuns* (from Lat., *frango*, I break), a term applied to designate a part of any magnitude, integer (whole number), or unit. For example, "two and a fraction" means two units and that part of a unit which can be distinguished as one-half, two-fifths, and so on. In the fraction $\frac{1}{3}$ in arithmetic, or $\frac{a}{b}$ in algebra, the figure 1 or a is the *numerator*, and 3 or b is the *denominator*; and they represent that, if a whole number is divided into *three* or b parts, only *one* or a parts are taken. In the addition of fractions, the fractions must be brought down to the same denominator, and their numerators (as expressed in the value of their new denominator) must then be added, when we have one whole fraction. The true definition of a *fraction* may be thus summed up:—It is the division of its numerator by its denominator; as *seven-eighths* are equivalent to the whole number 7 *divided* by 8—whence a fraction is obtained. Decimal fractions simplify calculations greatly, as they are constructed on the principle of having one common denominator—a multiple of ten; and thus fractions can be added, subtracted, and divided without repeating over and over the tedious process of bringing them down to a common denominator.

FRACTURE, *frak'-tshur* (Lat., from *frango*, I break), the term applied to broken bones. Fractures are divided into simple, compound, comminuted, and complicated. Simple fractures are those in which the fracture does not communicate with the external air. These are by far the most common, and usually affect the shaft of long bones, this part being the most subject to injuries of this description. Compound fractures are those in which one or more bones are broken, and the fracture communicates with the external air by means of a wound in the soft parts. Comminuted fractures are those in which the bones are broken into several portions; while complicated fractures are such as are complicated with some other injury; as a wound of the principal artery of the limb. Fractures are also distinguished as transverse, oblique, or longitudinal, according to their direction. The treatment of fractures consists in restoring the broken fragments, as nearly as possible, to their former positions, and securing them in that state. When the limb has been reduced, or set, it is to be placed in *splints*, which are thin pieces of wood, or other material of the requisite firmness and length, shaped and hollowed out, so as to fit evenly without making undue pressure upon any part. The period taken for the healing of a fracture varies according to the bone broken, the age, constitution, &c., of the patient. It is quicker in children than in adults, and in adults it is slowest in old age. The treatment of compound fracture consists in placing the broken bones in opposition, and healing the external wound, so as to convert the compound into a simple fracture.

FRAGARIA, *frag-ai'-re-a* (from Lat., *fragrans*, fragrant). (*See* STRAWBERRY.)

FRAMBOESIA, OR YAWS, *fram-bo-e'-ze-a* (Fr., from *framboise*, a raspberry), a disease of the skin, indigenous to the Antilles as well as Africa. It consists of imperfectly suppurating tumours, which gradually increase in size until they become as large as, and somewhat resemble, a raspberry. It seldom proves dangerous, and is propagated solely by the contagion of the matter discharged from the eruption when applied to the broken skin of another person who has not previously had the disease; for it only affects the same person once.

FRANCOACEÆ, *fran-ko-ai'-se-e*, the *Francoa* family, a natural order of *Dicotyledones*, sub-class *Calyciflorœ*, consisting of stemless herbs. There are but two genera—*Francoa* and *Tetilla*, and five species, all natives of Chilli. The *Francoas* are reputed to be cooling and sedative; *Tetilla* is astringent, and is employed as a remedy for dysentery.

FRANCOLIN, *fran'-ko-lin.*—A genus of birds of the family *Tetraonidœ*, having a great resemblance to partridges, natives of Europe, Asia, and Africa.

FRANKENIACEÆ, *frank-e-ne-ai'-se-e* (after John Frankenius, professor of botany at Upsal), the *Frankenia* family, a natural order of *Dicotyledones*, sub-class *Thalamiflorœ*, consisting of herbs and under-shrubs. The plants of the order chiefly occur in the South of Europe and North of Africa, but are found in other parts. They are mucilaginous and slightly aromatic. The leaves of a species of Beatsonia are used at St. Helena as a substitute for tea.

FRANKINCENSE, *frank-in'-sense* (Ang.-Nor.), a name given to a species of gum-resin derived from the *Boswellia serrata*, and imported from the Levant. By melting it in water, and straining it through coarse cloths, it is cleaned from a good deal of the oil which is one of its component parts—the oil which is extracted being termed Burgundy pitch, or white resin. If frankincense is sprinkled on coals, it emits a peculiar aromatic odour; whence its name. It is now used in the services of the Roman Catholic Church; and in ancient times by the Jews, Greeks, and Romans.

FRASERA, *fra-se'-ra* (named after John Fraser, a collector of North-American plants), a genus of herbs belonging to the natural order *Gentianaceœ*. The root of the species *F. carolinensis*, or *Walteri*, has properties similar to gentian-root, but is less powerful. It is known as American columba.

FRAXINUS, *fraks'-e-nus*. (*See* ASH.)

FRECKLES, *frek'-ls* (Lat., *lentigines*), small yellow or brownish spots which appear on the face, especially of fair persons much exposed to the weather. Various applications have been proposed for their removal; one of the best is a liniment composed of lime-water and oil, with the addition of a little ammonia.

FREESTONE, *free'-stone* (Sax., *stan*, stone), the name generally given to any soft stone that can be readily sawn and worked with the mallet and chisel. The various kinds of stone that come from the quarries near Bath, and those near Portland, and in the Isle of Purbeck, are freestones; and some kinds of limestone are also included under this term, as well as soft sandstones and oolites.

FREEZING, *freez'-ing* (Ang.-Sax.), the solidification or congelation of water or atmospheric vapour by cold. Water begins to freeze when the temperature of the atmosphere is 32° Fah., at which point ice begins to appear, and continues to be formed, unless some circumstance, such as the disturbance of the water, interferes. As the cold increases, other liquids, which are able to resist the temperature at which water congeals, begin to freeze, and pass into the solid form.

FRENCH BERRIES. (*See* RHAMNUS.)

FRENCH CHALK, *frentsh tchawk*, a kind of soap-stone of a soft and greasy nature, known by that name, and sometimes called Briançon chalk, because it is obtained in great quantities near that town, and in other parts of France. It forms a white pigment when properly prepared, and is much used by tailors in marking the pattern of garments on cloth, before cutting them out, as the marks made can be easily obliterated, and cause no injury to the material. It is used also by bootmakers, in the form of powder, as a small portion shaken into a new boot makes it more easily drawn on.

FRESH-WATER HERRING. (*See* COREGONUS.)

FRESH-WATER MUSCLE, *mus'-sel.*—The popular name of a family of lamellibranchiate molluscs, *Unionidœ*, allied to muscles. All the species are inhabitants of fresh water, and they are more abundant in North America than in Europe. The inside of the shell has a brilliantly coloured lining, which is sometimes used as a substitute for mother-of-pearl, and pearls are sometimes produced, especially in the molluscs found in the Welsh and Scotch rivers. One pearl from the Conway, presented to Queen Catherine, wife of Charles II., by Sir Richard Wynn, is preserved among the crown jewels. There are four British species; one, *Unio margaretifera*, found in the streams of mountainous districts, furnishes most pearls.

FRESH-WATER STRATA. (*See* GEOLOGY.)

FRICTION, *frik'-shun* (Lat., *frictio*), the resistance which a moving body meets with from the surface of the body on which it moves. As no surfaces are perfectly smooth, the imperceptible asperities, which may be supposed to exist on all surfaces, however highly polished, become to some extent interlocked, and a certain amount of force is requisite to overcome the mutual resistance to motion of the two surfaces, and to maintain the sliding motion even when it has been effected. By increasing the pressure, the resisting power of friction is increased; while, on the other hand, by rendering the surfaces more smooth, and by lubrication, the resistance to motion is diminished, although it cannot entirely be avoided. Friction is essentially a passive resistance, a negative force, produced by pressure, to which it bears such relation that its amount may be measured by the same unit, and be enunciated in the same terms. It is always found that the friction is greater between substances composed of the same material than between the surfaces of heterogeneous bodies.

FRIGATE BIRD (*Fregata Aquilus*, Ray), a bird common on the intertropical American coasts, and in the Atlantic and Pacific oceans. It is allied to the cormorants, but differs from them by having a forked tail, short feet, the membranes of which are very deeply notched, an extraordinary spread of wing, and a beak, both mandibles of which are curved at the tip. The plumage is, on the upper parts purple black, the throat and belly white, and the beak red. The frigate-bird is incapable of either swimming or diving; but it seizes fish when they appear at the surface, or, as in the case of flying-fish, above it; and it attacks such gannets and sea swallows as may be returning with full pouches to their nests in the rocks. The frigate-bird soars above its victim, and then, plunging down, strikes it on the head with its beak; the result is an instant disgorging of the day's fishing, which, as it falls, is followed by the robber, who invariably overtakes and secures it before it reaches the water.

FRIGID ZONE. (*See* ZONE.)

FRINGE, *frinj*, in Optics, fringes are coloured bands of diffraction, appearing when a beam of light is transmitted through a small orifice.

FRINGE TREE, a genus of plants (*Chionanthus*), of the natural order *Oleaceæ*, natives of America, the West Indies, Ceylon, and Australia. They are either small trees or large shrubs. The snow-flower (*C. Virginica*), the common fringe tree is found throughout the United States. It is from 10 to 20 feet in height, and the corolla is divided into four large linear segments, whence it takes its name. It is cultivated as an ornamental plant.

FRINGILLIDÆ, *frin-jil'-le-de* (Lat., *fringilla*, a chaffinch), a term applied to a class of birds belonging to the order *Insessores* and its division *Conirostres*. They are characterised by a broad-based, sharp-pointed conical beak, the size of which, in comparison with their head, is something enormous. It is well known that the *Fringillidæ* feed almost entirely upon different seeds of plants and nuts; consequently their beak is required to be strong in order to enable them to obtain their food. The class includes all buntings, crossbills, grosbeaks, linnets, canary-birds, finches, and many other conirostral birds. The *Fringillidæ* are frequently known under the general term of Finches. (*See* FINCHES.)

FRIT.—A very small insect of the same family as the house-fly, which, in some parts of the north of Europe commits great ravages on the barley crops.

FRITILLARY, *frit'-il-la-re.*—A genus of plants, of the natural order *Liliaceæ*, bulbous rooted with bell-shaped pessarid of six sigments. About 20 species are known, natives of the northern temperate regions. They have drooping flowers, and some of the species are very beautiful. The common Fritillary (*F. meleagris*), is found in pastures in the southern and eastern parts of England. It is about a foot high, and the flowers are marked with dark spots.

FROG, *frog* (Sax., *froga*).—A genus (*Rana*) of the order *Batrachia*. Frogs are chiefly distinguished from toads by the unusual length of the hind feet, which are strong and well-palmated; hence, their great power both of jumping and of swimming; their skin also is smooth; and there is not only a row of fine teeth round the upper jaw, but the palate also is furnished with another row placed transversely. It is one of the many singularities of these animals, that while in the young or tadpole state, they are herbivorous, living only upon aquatic plants, yet no sooner do they effect their metamorphosis, than they become carnivorous, pursuing slugs, insects, &c., and consuming them alive or dead. The frog deposits its ova or spawn some time in March, in a clustered gelatinous mass. This lives for a month or five weeks, and at the end of that time, there issues from each little black globule a living tadpole. In this their first stage the young frogs have elongated bodies, laterally-compressed tails, and external branchiæ; their small mouths are furnished with small hooks or teeth, for the separation of vegetable matter, and they have small tubes on the lower lips, by which they attach themselves to aquatic plants, &c. The external branchiæ next disappear, and become covered with a membrane, being placed in a sort of sac under the throat; and the animal then breathes after the manner of the fishes. Furnished with eyes and nostrils, the body of the animal is distended with the great extent of the digestive canal, and it has a large tail for swimming. Soon, however, the posterior limbs are gradually put forth near the origin of the tail, and are developed first; the anterior feet then begin to show themselves; the tail gradually becomes less and less, shortens, shrinks, and seems at last to be absorbed; the mouth widens, and loses its horny processes or jaws; the eyes are guarded by eyelids; the belly lengthens and diminishes in comparative size; the intestines become short; the true lungs are developed, and the internal branchiæ are obliterated; the circulation undergoes an entire change; and the animal, hitherto entirely aquatic and herbivorous, becomes carnivorous, and for the most part terrestrial. In the frog the muscular system, especially the muscles of the abdomen, are more developed than in the other reptiles; offering in this particular some analogy to the abdominal structure of the mammifers. But it is in the disposition of the muscles of the thigh and leg in the frogs and other anurous batrachians, that the greatest singularity is manifested. These, whether taken conjointly or singly, present the greatest analogy with the muscular arrangement in the same parts in man. We find the rounded, elongated, conical thigh, the knee extending itself in the same direction with the thigh-bone, and a well-fashioned calf to the leg, formed by the gastrocnemii muscles. It is impossible to watch the horizontal motions of a frog in the water, as it is impelled by these muscles and its webbed feet, without being struck by the complete resemblance in this portion of its frame to human conformation, and the almost perfect identity of the movements of its lower extremities with those of a man making the same efforts in the same situation. By the aid of these well-developed lower limbs and the prodigious power of their muscular and bony levers, a frog can raise itself in the air to twenty times its own height, and traverse in a single bound a space nearly fifty times the length of its own body. There are several species of frogs. The red frog (*R. temporaria*) abounds in most parts of England and Scotland. The green, or edible frog (*R. esculenta*) is found in central and southern Europe, where it is cultivated and fattened as an article of food. Among the most peculiar may be mentioned the bull-frog of North America (*Rana pipiens*) and the tree-frog (*Hyla leucomystax*, Graves). The former is a very large species, measuring eight inches in length and four in width. Its colour is olive on the upper part, and greenish-white darkly spotted on the belly. It is said that this frog frequents springs only, and, although it is a great destroyer of young goslings, it is tolerated from the benefits derived from its scavenger habits. Its chief peculiarity is its voice, which resembles the distant bellowing of a bull. Of the tree-frog there are several species. They are found in France, Germany, and Italy, as well as in America and Asia. Africa also produces a singular race of frogs, which, from having some of their toes enveloped by a conical horny claw or cap, have been termed *Dactylethræ*, or thimble-toed.

FROG-FISH. (*See* ANGLER-FISH.)

FROND, *frond* (Lat., *frons*), the leaf of a fern or other acotyledonous plant. Fronds are seldom articulated; they are either sessile or stalked; are frequently toothed or incised in various ways, and are often highly compound.

FRONTAL, *front'-al* (Lat., *frons*, the forehead), denotes of or belonging to the forehead: as the frontal bone, arteries, nerves, &c.

FROST. (*See* FREEZING.)

FROST-BITE. (*See* CHILBLAIN, GANGRENE.)

FRUCTOSE, OR FRUIT-SUGAR, *fruk'-toze* (Lat., *fructus*, fruit), found in most ripe fruits, and producible from starch and ligneous bodies by acting on them with dilute sulphuric acid. (*See* SUGARS.)

FRUIT, *frute* (Lat., *fructus*), that part of the plant which is formed by the ripening of the ovary and its contents, after the process of fertilization. The fruit consists essentially of the mature ovary, with its seeds or ripened ovules; but other parts of the flower may enter into its composition. Thus in cases where the calyx is adherent to the ovary, as in the apple, melon, and gooseberry, that organ necessarily forms part of the fruit; in the rose, the concave thalamus, which bears the carpels on the inner surface, becomes a portion of the fruit; in the strawberry, again, the fruit consists of a succulent hemispherical thalamus, bearing the carpels on its convex surface; in the acorn, hazel-nut, and filbert, it consists of pistil, calyx, and bracts, combined together; while in the pineapple, it is composed of the ovaries, floral envelopes, and bracts of several flowers. As the ovary ripens into the fruit, it frequently undergoes important alterations, from the addition or the obliteration of certain parts. The fruit is *simple* when it is formed of a single carpel, and when it is the only one produced by the single flower. The legume and the drupe are examples. The *apocarpous* fruits are formed of single carpels, but several are produced by a single flower. Those fruits are *syncarpous* which are formed by the more or less complete combination of two or more carpels, and of which only one is produced by a single flower. Fruits formed by the combination of several flowers form a distinct class. They are sometimes called *anthocarpous* fruits. In the majority of fruits, the pericarp or shell consists simply of the walls of the ovary in a modified state; but where the calyx is adherent, it necessarily presents a more complicated structure. It is divided into three layers or regions—the external, called *epicarp*, or *exocarp*; the middle, called *mesocarp*, or sometimes, in allusion to its fleshy or succulent nature, the *sarcocarp*; and the inner, called the *endocarp*, or, when very hard, the *stone* or *putamen*. The pericarp either opens to allow the seeds to escape, or it remains closed, and the seeds can only become free by its decay. In the former case, the fruit is said to be *dehiscent;* in the latter, *indehiscent*. Dehiscent fruits open in various ways. When a fruit separates more or less completely into two or more pieces, called *valves*, or even when it opens by a single longitudinal slit, it affords an example of *valvular* dehiscence. When the opening takes place by a transverse line through the fruit, so that the upper part is separated from the lower, like the lid of a pill-box, the dehiscence is said to be *transverse* or *circumscissile*. A third kind of dehiscence, called *porous*, is distinguished. The seeds escape through little pores or slits, formed irregularly in the substance of the fruits, by a process called rupturing. (*See* OVARY, SEED.)

FRUSTUM, *frus'-tum* (Lat., *frustum*, a morsel or gobbet), in Geometry and Mathematics, the name applied to any piece cut from any solid figure, but more particularly to the bottom of a cone or pyramid, from which the upper part, which contains the apex, has been cut away.

FUCACEÆ, *fu-kai'-se-a* (Gr., *phukos*, sea-wrack), a sub-order of *Algæ*, distinguished by their organs of reproduction. Some species attain a great size, having fronds 1,000 feet long, the stem being in no part more than an inch in diameter. *F. vesiculosus*, commonly known as the sea-wrack, is much used during the winter months in some of the islands of Scotland for feeding horses and cattle. The expressed juice of its vesicles has been used medicinally as an internal remedy, and frictions of the plant have been employed externally in glandular and scrofulous affections. It was formerly extensively employed for making kelp.

FUCHSIA, *fu'-she-a* (so named in honour of Fuchs, a famous German botanist of the 16th century), a genus of shrubs belonging to the natural order *Onagraceæ*. The species *F. coccinea*, a native of South America, was introduced into this country at the close of the last century, and is now one of our commonest greenhouse and window shrubs. It is a very elegant plant: the young wood and nerves of the leaves are tinged with purplish-red; the flowers are produced from the axils of the leaves, and hang in a most graceful manner by thread-like peduncles. Many species have been introduced into Britain, and an immense number of beautiful varieties have been developed by cultivation. The fruits of several fuchsias are somewhat acid, and may be eaten.

FULGORA, *ful-go'-ra* (Lat., *fulgur*, lightning). (*See* LANTERN-FLY.)

FULGARITES, *ful'-ga-rites.*—Small tubes, seldom exceeding an inch and a half in diameter, with an internal surface of a hard glassy character, supposed to be formed by the action of lightning melting and vitrifying the sand in sand-banks.

FULLER'S EARTH, *ful'-lerz erth*, a porous soft silicate of alumina, having a strong attraction for greasy matters. If made into a paste with water, and laid upon a greasy spot, it removes the fatty or oily matter by capillary attraction. It is largely used to cleanse woollen fabrics from the grease contained in the wool from which they are made. It is found abundantly near Reigate, in Surrey.

FULMAR, *ful'-mar* (Gaelic, *fulmaire*).—One of the largest of the petrels of the northern hemisphere, abundant in Europe and North America. The fulmar (*Fulmaris glacialis*), known to seafarers as the "Motley Mawk," breeds extensively in St. Kilda and Skye. In the former island, the young are only permitted to be taken in the first week of August, and then it is not unusual for nearly 20,000 to be killed. After the oil (which possesses nearly all the qualities of cod-liver oil) has been extracted, the birds are stored as winter food for the islanders.

FULMINIC ACID, *ful-min'-ik* (Lat., *fulmen*, a thunderbolt, from the noise produced by the explosion of its compounds), an acid possessing the same composition as cyanic and cyanuric acids, but having totally different properties. It is not known in an isolated state, but it forms compounds with the metals possessed of powerfully explosive properties.

FUMARIACEÆ, *fu-ma-re-ai'-se-e*, the Fumitory family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*, consisting of 15 genera and about 110 species, principally occurring in thickets and waste places in the temperate latitudes of the nothern hemisphere. They are smooth herbs, with a watery juice. The *Fumariaceæ* possess slightly bitter, acrid, astringent, diaphoretic, and aperient properties. Some species are cultivated in our gardens and greenhouses. Of these the most important is *Dicentra spectabilis*, which has very showy, but scentless flowers. The order is named from *Fumaria*, one of the genera.

FUNCTIONS, *funk'-shuns.*—In Mathematics, when, in an equation, two or more variables are combined with constants, and a change of the value of one variable implies a corresponding change in the other, such variables are said to be functions of each other.

FUNDI, OR FUNDUNGI. (*See* RASPALUM.)

FUNGI, *fun'-ji* (Lat.), the Mushroom family, a natural order of *Acotyledones*, sub-class *Thallogenæ*, consisting of parenchymatous cellular plants, growing in or upon damp mould; in or upon the wood and the herbaceous parts of living or dead plants; upon living or decaying animal substances, and in solutions of organic materials. A great number of species are microscopic plants. Fungi have been divided into six sub-orders, which respectively include the mushrooms and their allies, the puff-balls, the smuts, the mildews, the truffles and morels, and the moulds. (*See* AGARICUS, AMANITA, LYCOPERDON, CORDYCEPS, UREDO, PUCCINIA, TUBEE, MORCHELLA, PENICILLIUM.)

FURZE. (*See* ULEX.)

FUSANUS, *fu-zai'-nus*, a genus of the natural order *Santalaceæ*. The species *F. acuminatus* yields the quadrung nut of Australia, an edible fruit resembling the almond in flavour.

FUSUS, *fuse'-us* (Lat., a spindle), a genus of gasteropodus molluscs, nearly allied to *Murœ*. The shell is about six inches long. One species is known in the South of England as the red whelk. It is often used as a bait for cod and other fish.

G.

GAD-FLY. (*See* BOT FLY.)

GADIDÆ, *gai'-de-de* (Lat., *gadus*, a cod-fish), a family of fishes of the soft-finned order; as the Cod. They are easily known by the position of the ventral fins under the throat and the pointed character of those fins. The body is long, rather compressed, and covered with small soft scales. The greater number of the species live in cold or temperate seas, and furnish the greater portion of the fish obtained in England and America.

GALACTODENDRON, *gal-ak-to-den'-dron* (Gr., *gala*, milk; *dendron*, a tree). (*See* BROSIMUM.)

GALAGO, *gai-la'-go.*—A genus of mammalia of the Lemur family, remarkable for the length of the hind-legs and the ears. They are natives of Africa and Madagascar. They are very active, and make rapid jumps to catch insects. In Senegal they are prized as food.

GALANGLE, *ga-lan'-gle.*—A genus of plants of the natural order *Zingiberaceæ*. The root-stocks possess stimulating properties similar to those of ginger, in the eastern archipelago.

GALANTHUS, *gal-an'-thus* (Gr., *gala*, milk; *anthos*, flower).—The Snowdrop, a genus of the natural order *Amaryllidaceæ*. The species *G. nivalis* is found growing wild in our thickets, and is much cultivated in borders for the sake of its early and pretty blossoms. It is a bulbous plant; the flower is solitary, white, and drooping, the inner segments being greenish.

GALAXY. (*See* MILKY WAY.)

GALBANUM, *gal'-ba-num* (Lat.), a fetid gum-resin used in medicine internally as an antispasmodic, and externally as a stimulant and discutient application to indolent tumours and chronic swellings. It is imported from India and the Levant; but botanists have, as yet, been unable to determine the plant yielding this resin.

Galbanum is officinal in our Pharmacopœias, and is supposed to be the same substance as the *chelbenah* of Scripture.

GALBULUS, *gal'-bu-lus* (Lat., the nut of the cypress-tree), a kind of fruit generally regarded as a modification of the cone.

GALENA, *ga-le'-na* (Gr., *galene*, tranquillity, on account of its supposed effect in mitigating disease), an important mineral, forming the principal ore of lead. It is a protosulphide of the metal, and is found crystallized more or less distinctly in cubes of a deep leaden colour and strong metallic lustre. It is found in veins in crystalline rocks, and most abundantly in carboniferous limestone.

GALERITIES, *ga-le-ri'-teez* (Lat., *galea*, a helmet), a genus of fossil sea-urchins, abounding in the Chalk formation, and from their shape popularly known in Kent and Sussex as "sugar-loaves."

GALIACEÆ, *gal-e-ai'-se-e* (from *galium*), the Madder family, a natural order of *Dicotyledones*, sub-class *Corolliflorœ;* common weeds in the northern parts of the northern hemisphere, and also in the high mountainous districts of Peru, Chili, and Australia. The *Galiaceœ* are chiefly remarkable for the presence of a colouring matter in their roots. (*See* RUBIA.) Some have valuable medicinal properties. (*See* GALIUM.)

GALIPEA, *ga-le-pe'-a*, a genus of the natural order *Rutaceœ*. The species *G. officinalis* and *cusparia* yield the drug known as Angustura or Cusparia bark. They are natives of South America. (*See* ANGUSTURA BARK.)

GALLA OX. (*See* SANGA.)

GALL-BLADDER, *gawl* (Sax., *gealla*, gall; Lat., *vesicula fellis*), an oblong membranous receptacle, situated on the concave side of the liver, under the right lobe. It is about the size of a small hen's egg, and resembles a pear in shape. It has three coats—an external or peritoneal, a middle or fibrous, and an internal or villous. The inner coat has a reticulated honeycomb appearance, but does not possess any follicles for the purpose of secretion. It serves as a reservoir for the bile, which, when digestion is not going on, regurgitates through the cystic duct, and is retained for future use. The cystic duct connects the gall-bladder with the hepatic duct, which proceeds from the liver, and the two, when united, form the *ductus communis choledochus*, by which the bile is conveyed to the duodenum.

GALL FLY.—A genus of insects (*Cynips*) forming the family *Gallicolœ*. The females deposit their eggs in a puncture made in a leaf. This puncture produces a tumour, which develops into the excrescence known as "gall," within which the eggs undergo this transformation, the perfect insects eating their way out.

GALLIC ACID, *gal'-lik* (from *galls*).—This important vegetable acid exists ready formed in the gall-nut, in sumach, in valonia, and in a large number of other astringent vegetables. It is readily obtained by allowing an infusion of gall-nuts, or powdered gall-nuts freely moistened with water, to stand in a warm place for some weeks. A species of fermentation is set up, during which the gallic acid is formed in large quantities by the decomposition of the gallotannic acid or tannin contained in the galls. Gallic acid crystallizes in silky needles or brilliant rhomboidal prisms, which dissolve in 100 parts of cold water and three parts of boiling water. It is freely soluble in alcohol, but sparingly so in ether. Heated to a temperature of from 410° to 420°, gallic acid sublimes, and is wholly converted into pyrogallic and carbonic acids. If the temperature passes 480°, melagallic acid is formed. Gallic acid is extensively used as a source of pyrogallic acid, so largely employed in photographs.

GALLINACEOUS BIRDS, *gal-lin-ai'-she-us* (Lat., *gallus*, a cock), the name applied to such birds as, in common with the domestic cock, have the upper mandible vaulted, the nostrils pierced in a large membranous space at the base of the beak, and covered by a cartilaginous scale; wings short, flight laborious, and carriage heavy. Birds of this order have extremely powerful gizzards, and generally large globular crops.

GALLINULE, *gal'-li-nule*, a genus of birds, of the family *Rallidœ*, nearly allied to the coots. Only one species, the Water-hen, or Moor-hen, is found in Britain.

GALLIUM, *gal'-le-um*, a new elementary metal discovered by M. Lecoq de Boisbaudran, in 1875.

GALLITANNIC ACID. (*See* TANNIC ACID.)

GALLS, *gawlz* (Ssx., *gealla*, a gall), excrescences produced on the branches and leaves of trees by the attacks of insects. (*See* GALL FLY.) Oak-trees are especially liable to be thus attacked. Galls are extensively employed in tanning, for making ink, and for other purposes in the arts. (*See* QUERCUS.)

GALL-STONES. (*See* CALCULUS.)

GALVANISM, *gal'-van-izm*.—The science which relates to the phenomena connected with a peculiar form of electrical force obtained by certain arrangements of metals and liquids. Galvani, a professor of anatomy at Bologna, in 1789, made the discovery that the transmission of electricity through the nerves of a frog, recently killed, would excite muscular contractions; and he afterwards found that similar convulsions could be produced by merely touching the nerves and muscles with two different metals and then bringing the metals into contact. Upon these and similar phenomena, observed in an extended series of experiments with different animals, Galvani based his theory of "animal electricity," which was received with enthusiasm by the Italian physiologists of his day. According to this theory, every animal is endowed with an inherent constitutional electricity, generated in the brain and distributed through the nervous system, the principal reservoirs being the muscles. Volta, a professor of natural philosophy at Pavia, repeated Galvani's experiments, and proved that the contractions in the muscular fibre depended, not on any peculiar electrical condition of the animal frame, but on a feeble action derived from the metals with which the nerves and muscles were brought into contact. To determine the exact conditions under which electrical disturbance is produced, he commenced a course of experimental researches on the energies of different metals, which eventually led him to the discovery of the *pile*, an apparatus which must be regarded as the source of all the great discoveries relating to electricity made in modern times. Two theories have been offered in explanation of the action of the voltaic pile or battery. The *contact theory* of Volta assumes that different metals have different electrical capacities, and that electrical disturbance results from simple contact. A *galvanic pair* is an arrangement consisting of two plates (copper and amalgamated zinc), dissimilar in conducting power, immersed in a liquid which acts chemically on one of them, and capable of being placed in conducting connection. The liquid employed is water, with a small quantity of sulphuric acid, and the connection between the plates is by wires of copper or other conductor of electricity. Faraday and others have proved that chemical action does give rise to electrical force; that when the chemical action of a battery diminishes or ceases, the voltaic current also diminishes or ceases; and that powerful currents may be generated without bringing dissimilar metals into contact. (*See* ELECTRICITY.) The current force of the voltaic battery has been practically applied to many useful purposes. It is employed in telegraphy to deflect magnetic needles at a distance of thousands of miles. Its power of causing chemical decomposition has been turned to account by the metal-worker, the engraver, and the calico-printer. (*See* ELECTROTYPE; ELECTRO-PLATING AND GILDING; ELECTRO CALICO-PRINTING.) The current is also much used as a remedial agent in the treatment of many forms of disease of the human body; decided relief has been obtained in paralysis, lockjaw, St. Vitus's dance, tic-doloreux, and deafness. Though the term *galvanism* is still commonly applied to the science relating to the current force, it is certainly less appropriate than either *voltaic electricity* or *voltaism*, for the observations of Galvani were unimportant compared with those of his great follower, Volta.

GAMA GRASS, a genus of grasses (*Tripsacum*). Only two species are known, the *T. Dactyloides* of Mexico, very valuable as a fodder grass, and the *T. Monostachyan* of Carolina. The name Gama is supposed to be derived from that of a Spaniard who first collected it in Mexico.

GAMBOGE. (*See* CAMBOGE, GARCINIA.)

GAMMARUS, *gam'-ma-rus*.—A genus of *Crustacea*, including one species, the Fresh-water Shrimp (*G. pulex*), well known in this country. It is very small.

GANGLION, *gang'-le-on*.—A small rounded or elongated nervous mass, of a reddish-grey colour situated in the course of the nerves. Ganglions are of two kinds, one forming part of the cranial system of nerves, and situated near the origins of many of the cranial and all of the vertebral nerves; the other forming part of the sympathetic system, extending in a series along each side of the vertebral column, and occurring numerously in other parts. They differ widely from each other in figure and size, some of them being large and conspicuous, while others may be almost termed microscopic.

In Surgery, a small indolent fluctuating tumour, developed in the course of the tendons, and containing a semi-fluid secretion inclosed in a cyst, generally communicating with the tendonous sheath. Ganglions sometimes form without any apparent cause, but generally they arise from some wrench or tension of the tendon. They are most frequently situated about the wrist, and the swelling is usually globular; but when much enlarged, it is rendered irregular by the pressure of the tendons.

GANGRENE, *gang'-green* (Gr., from *grao*, I feed upon), a term applied to the first stage of mortification, so called from its eating away the flesh. It is divided into two kinds—the moist and the dry; the former, called also inflammatory or acute gangrene, is that which is preceded by inflammation; while the latter, called also chronic or idiopathic gangrene, is that which takes place without any visible inflammatory action having preceded it. The most frequent causes of grangrene are violent inflammation, erysipelas, contusions, burns, cold, deficient circulation of the blood or nervous energy. Gangrene may also arise from a diseased state of the blood-vessels, attended with debility of the constitution, a form of the disease commonly known as *gangrena senilis*. It rarely occurs except in advanced life, and usually attacks the lower extremities, proceeding from the toes upwards. Hospital gangrene, or *phagedæna gangrenosa*, is a form of this disease which attacks open wounds or ulcers, and is so called from its appearing most frequently in crowded hospitals, and causing a fearful mortality among the patients. Its symptoms and treatment are similar to those already mentioned.

GANNET, OR SOLAN GOOSE, *gan'-net* (Sax., *ganot*).—A genus (*Sula*) of web-footed birds of the family *Pelecanidæ*. In the North of Scotland, the Hebrides, and in Norway, this bird is very abundant. It is almost the size of the tame goose. The bill is about six inches long, jagged at the sides, and straight nearly to the point, where it inclines downwards. A loose skin, bare, and capable of considerable distension, hung from the blade of the lower bill, and extended over the throat, serves as a pouch in which to convey food to its young. The neck of the gannet is long; body flat, and very full of feathers. The crown of the head and a small space on the hind part of the neck are buff-colour, and, with the exception of the quill and the bastard wing-feathers, the remainder of the plumage is white. The legs and toes are black, but the forepart of each is marked with a bright green stripe. The food of the gannet consists of salt-water fish, the herring and pilchard being the staple. It takes its prey by darting down on it from a considerable height. It makes its nests, which are composed chiefly of turf and sea-weeds, in the caverns and fissures of rocks or on their ledges, as well as on the plain surface of the ground. The female lays three white eggs, somewhat smaller than those of the goose. It is stated, however, that the three eggs are only laid in the event of the first and second being removed; and that if left to its own devices, the bird will lay but one egg. These birds are found in great abundance on the island of Kilda, a little spot standing remotely westward in the Atlantic Ocean; on the Bass Rock in the Firth of Forth, and on some parts of the coast of Ireland.

GANOID FISHES, *gai'-noid* (Gr., *ganos*, "splendour."—Fishes with shining scales, as the sturgeon. There are not many living species; but fossil species are numerous.

GAPES, a disease to which fowls are subject, caused by the presence of small worms in the windpipe. Twenty of these worms have been found in one chicken, and partridges and pheasants are also subject to them. Sometimes they can be removed by an oiled feather, or destroyed by putting a little *Epsom salts* into the food. If undisturbed, inflammation and death frequently result.

GARCINIA, *gar-sin'-e-a.* (*See* MANGOSTEEN.)

GARDENIA, *gar-de'-ne-a.*—A genus of the natural order *Cinchonaceæ*. From the fruits of *G. grandiflora*, *florida*, and *radicans*, beautiful yellow dyes are prepared, which are extensively used in China and Japan. The genus was named after Dr. Garden, of Charleston, South Carolina.

GARFISH, *gar'-fish* (*Esox Belone*, Linn.), a fish of the Pike family, common on the English, Irish, and Scotch coasts. It is about two feet in length, body tapering towards the tail, and of small circumference; beak-like snout; teeth minute and numerous; tail considerably forked. It possesses many names besides that here applied to it, and among the rest, "mackerel guide," because of its supposed habit of preceding the shoals of mackerel in their annual visits to shallow waters for the purpose of Spawning. It is sold in the London market. The flavour somewhat resembles that of mackerel.

GARGANEY. (*See* TEAL.)

GARLIC. (*See* ALLIUM.)

GARNET, *gar'-net* (Fr., *grenat*).—One of the precious stones or gems. It is found in rhombic dodecahedra, and consists chemically of the double silicate of lime and alumina, coloured by iron and manganese. When cut *en cabochon*, garnets are known as carbuncles (from *carbunculus*, a little coal). The Noble Garnet, or *Alamandine*, is of a crimson red colour. The finest garnets come from Pega. The pryrope is a species of garnet found in Bohemia, coloured with sesquioxide of chromium. Powdered garnets, commonly known as "red emery" are used for polishing and cutting other stones.

GARROT, *gar'-rot.*—A genus (*Clangula*), of the oceanic section of ducks. The Golden-eye (*C. vulgaris*) is well known in this country in the winter months.

GARRYACEÆ, *gar-re-ai'-se-e* (after N. Garry, of the Hudson's Bay Company), the *Garrya* family, small natural order of *Dicotyledones*, subclass *Monochlamydeæ*. There are but two genera, which include six species, all shrubs found in the temperate parts of North America, or in the West Indies.

GAS, *gas* (probably from Ger., *geist*, a spirit).—This word was first applied by Van Helmont to denote any permanent vapour produced from solid or liquid substances by chemical action. The elementary gases are—hydrogen, oxygen, nitrogen, and chlorine. The principal compound gases are—hydrochloric, hydrobromic, and hydriodic acids; sulphurous acid, nitrous acid, peroxide of chlorine, chlorous acid, hypochlorous acid, carbonic acid, sulphuretted, phosphoretted, seleniuretted, and telluretted hydrogen; cyanogen, protoxide of nitrogen, deutoxide of nitrogen, carburretted hydrogen, olefiant gas, carbonic oxide, and ammonia. One of the most important properties of gas is its perfect elasticity. There is an entire absence of cohesion among the particles, constituting an essential difference between a gas and a liquid. A liquid in a vessel has a definite surface or limit, but a gas will fill any vessel that contains it. (*See* DIFFUSION OF GASES.

GASES, LIQUEFACTION OF.—Many gases which are aëriform at ordinary pressures and temperatures, may be condensed into liquids, and even solids, by the combined action of pressure and cold. Faraday proved that the difference between gases and vapours is only one of degree, gaseous carbonic acid bearing the same relation to the solid gas that steam does to ice. He employed a very strong tube closed at both ends and bent at an angle. One end contained the substances necessary for the production of the gas, while the other was immersed in a freezing mixture. Some of the gases are liquefied with greater facility than others; thus a mere reduction of temperature to 0° is sufficient to reduce sulphurous acid to a liquid state.

GAS-TAR. (*See* TAR.)

GASTEROPODA, *gas-ter-op'-o-da* (Gr., *gaster*, stomach; *pous*, foot), a class of molluscous animals, whose means of locomotion consist of a fleshy disc or foot situated under the abdomen. They are both terrestrial and aquatic, and naked and possessed of a shell. Of the naked Gasteropoda the common slug will serve as an example. Among the terrestrial of the genus is found the snail; and among the aquatic, the whelk, winkle, &c.

GASTRALGIA, OR GASTRODYNA, *gas-tral'-je-a, gas-tro-di'-ne-a.* (*See* CARDIALGIA.)

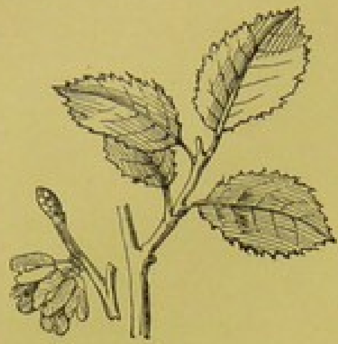
GASTRIC JUICE, *gas'-trik* (from *gaster*, the stomach), is the name given to the digestive fluid contained in the stomach, and which is secreted by the gastric glands on the introduction of food or other foreign substance. It is a clear transparent fluid, inodorous, a little saltish, and very perceptibly acid. Its most singular component is a peculiar organic substance called pepsine, to which its special properties are chiefly owing. The use of the gastric juice is to dissolve the various kinds of food in the stomach, reducing the albuminous and gelatinous portions of it to a state fit for absorption into the system.

GASTRITIS, *gas-tri'-tis* (Lat.), in Surgery, denotes inflammation of the stomach. It is known by pain in the epigastric region, increased when anything is taken into the stomach, vomiting, and hiccough; the pulse small and hard; and general prostration of strength, attended by fever and anxiety. It is produced by poisons of various kinds taken into the stomach, as arsenic or corrosive sublimate; by food of an improper nature; by draughts of any cold liquid when the body is much heated. It is a rapid and very dangerous disease, and requires prompt measures to be adopted.

GASTROCHÆNA, *gas-trok-e'-na.*—A genus of lamellibranchiate molluscs, having a delicate shell of two valves. It often takes possession of an existing cavity, which it lines with a calcareous matter, so as to form a tube to which the valves of its cell are cemented. One of these molluscs (*G. modiolina*), common in the Mediterranean, perforates shells and limestones, and have been known to bore through an oyster into the ground below.

GASTRODIA, *gas-tro'-de-a.*—A genus of orchids. The best known species is a native of Tasmania, and is sometimes known as the native potato.

GASTRONEMIUS, *gos-tro-ne'-me-us*, is the



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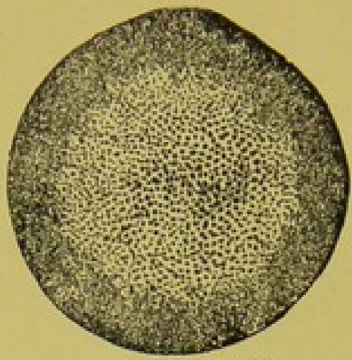
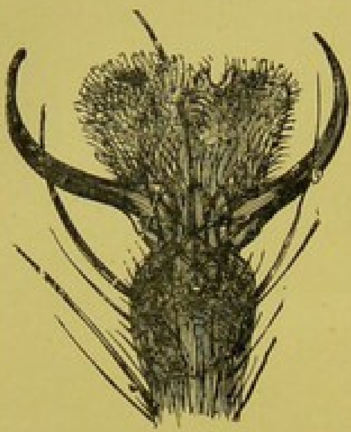
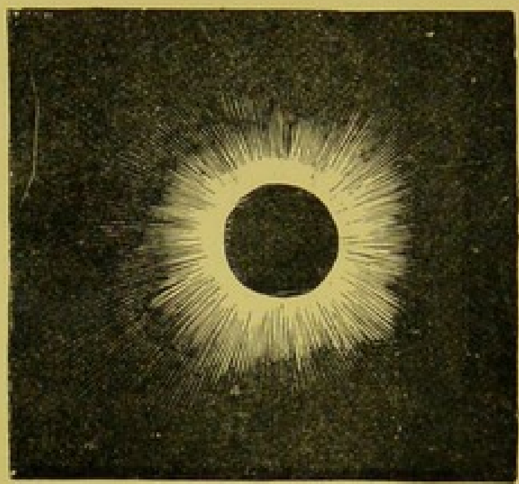


ENDOGENOUS WOOD (TRANSVERSE SECTION).

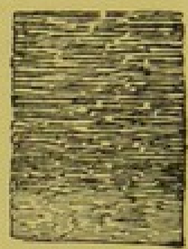
FIG-TREE.



FOOT OF FLY, MAGNIFIED.



SOLAR ECLIPSE WITH CORONA.



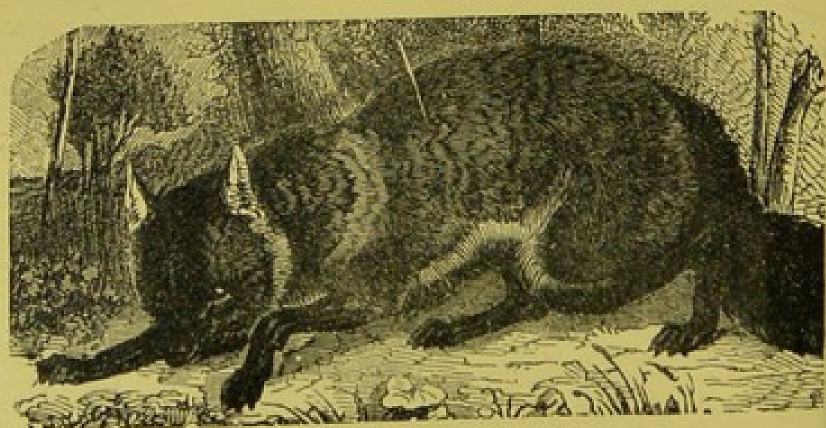
ENDOGENOUS WOOD (PERPENDICULAR SECTION).

TREE FROG.

FLY-CATCHER.

FLAMINGO.

FOSSIL FERN.



FOX.

name given to the muscles of the calf of the leg. The use of these muscles is to raise the heel and extend the foot.

GASTROTOMY, *gas-trot'-o-me* (Gr., *gaster*, and *tome*, an incision), an incision into the cavity of the abdomen, an operation sometimes resorted to in desperate cases; as where, in consequence of a rupture of the uterus, the child escapes into the peritoneal cavity. A somewhat similar operation, occasionally performed for the purpose of introducing food into the stomach, in the case of stricture of the gullet, and known as *gastrotomy*.

GAULT, *gawlt*, the term which is applied to a series of dark blue marls or calcareous clays, which occur between the upper and lower greensand of the chalk formation. The word "gault" is a provincial term for the clay itself, which is much used for brickmaking. When decomposed, it forms a very fertile soil, and is the main repository of the phosphatic nodules which are now so highly prized by the agriculturist.

GAULTHERIA, *gawl-the'-re-a.*—A genus of evergreen shrubs o fthe natural order *Ericeæ*, natives of temperate regions. *G. procumbene*, a native of North America, is known as Partridge Berry, Mountain Tea, and by other names. It is about five inches high, and has whitish flowers and red berries, which contain a pungent volatile oil, used as a stimulant and as a flavouring oil in perfumery. An infusion of the leaves is used as tea. A large species (*G. Shallon*) has purple berries eaten by the North American Indians. It has been transferred from America to this country as food for pheasants and other game. There are other species in Australia, Tasmania, on the Himalayas, and on the mountains of South America.

GAUR, *goor.*—A species of ox (*Bos Gaurus*), a native of the mountain jungles of India. It is of very large size, and has no dewlap. It is gregarious, being found in small herds, and is a bold and formidable animal, being respected, it is said, even by the tiger. It is supposed to be incapable of domestication.

GAVIAL, *gai'-ve-al.*—A genus of reptiles (*Gavialis*) of the crocodile family, but differing from true crocodiles and from alligators in the length and slenderness of the jaws. The only known species inhabits the Ganges. It is of great size, many specimens being 25 feet long.

GAYAL, *gai'-al.*—A species of ox (*Bos Gavæus*) found wild in the mountain regions of Central Asia, and domesticated in Aracan, Chillogory, the eastern part of Bengal, and other places. It is about the same size as the Indian buffalo. The milk of the cow is very rich, but not abundant.

GAZELLE, *ga-zel'* (Fr.) (*Antilope Dorcas*, Pallas), one of the most beautiful and graceful of the antelopes, chiefly inhabiting Arabia and Syria. It is about three feet six inches in length, and in height measures less than two feet at the shoulder. The horns of the adult male rise nearly perpendicularly above the orbits, are black, almost cylindrical, bending at first gently backwards, and finally forwards. The ears are long, narrow, and pointed; eyes large, mild, and black. The size of the gazelle about equals that of the roebuck; but the legs of the former are considerably longer, and the entire form more graceful. (*See* ANTELOPE.)

GEBANG PALM, *ge'-bang.*—A fan-leaved palm (*Corypha Gebanga*), native of the East Indies, and one of the most useful of palm-trees.

GECKO, *gek'-ko.*—A genus of reptiles of the lizard kind, of small size, natives of warm climates, and nocturnal in their habits. The name is taken from the peculiar cry of some of the species. The Gecko is credited with being venomous, and is known in Egypt as "the father of leprosy," but the character does not appear to be deserved. Insects are the chief food. From the formation of the feet, geckos can climb smooth surfaces, or walk inverted on ceilings. Two species are found in the South of Europe.

GELIDIUM, *je-lid'-e-um*, a genus of *Algæ*. From the species *G. corneum*, commonly known as *Algue de Java* in France, M. Payen first obtained the principle to which he has given the name of *gelose*. According to the researches of this chemist, one part of gelose dissolved in 500 parts of boiling water will afford, upon cooling, a colourless transparent jelly. Jellies made from this seaweed are much employed for food in Japan. Some of the species of Gelidium are supposed to afford the material used by a certain species of swallow in building the edible nests of China.

GELOSE. (*See* GELIDIUM.)

GEMINI, *jem'-e-ni* (Lat., the twins), the third constellation, or sign of the zodiac. The name of the Twins is given to the constellation from two remarkable stars of the first and second magnitude, to which the names of Castor (or α Geminorum) and Pollux (or β Geminorum) are given.

GEMMATION. (*See* REPRODUCTION.)

GEMS-BOK. (*See* ANTELOPES.)

GENERATION. (*See* PHYSIOLOGY.)

GENERATIONS, ALTERNATION OF, *jen-e-rai'-shunz* (Lat., *generatio*).—A term applied to a series of phenomena connected with the reproduction of the lower animals. In their development from the ovum to the adult state, a large number not only pass through various stages, but also possess the power of multiplying themselves at certain periods of their growth. The greatest incompleteness and the highest degree of mutual dependence is to be observed in Campanulariæ and similar polypes, in which the generations representing the unity of the species are very unlike each other, and in which all the individuals are fused into an outward unity, or into a set of polypes. The development of animals which do not belong to the water, but to the air, also presents similar phenomena, but in a still higher and more free stage. The propagation of the Aphides through a series of generations has been long known. In the spring, a generation is produced from the ova, which grows and is metamorphosed, and, without a previous fertilization, gives birth to a new generation, and this again to a third; and so on for ten or twelve weeks; so that, in certain species which have been observed, nine such changes have been noted. At last, there occurs a generation consisting of males and females, the former of which, after their metamorphosis, are usually winged; fertilization and the deposition of eggs take place, and the long series of generations recommences in the next year and in the same order.

GENET, *je'-net.*—A genus of quadrupeds (*Genetta*) nearly allied to the Civets, but in claws and eyes more nearly resembling the cats. They are smaller and more slender than the civets, and have only a rudimentary scent-pouch. Most of the species are natives of the warmer parts of Asia and of Africa; but one (*G. vulgaris*) extends into Southern Europe. The colour is grey, with dark spots, and the fur is valuable. Being easily domesticated, it often occupies the position of a domestic cat in Constantinople.

GENIPA, *jen'-i-pa*, a genus of the natural order *Cinchonaceæ*. Some species have edible fruit; thus the *G. Americana*, the lana-tree of South America, produces a delicious fruit called the *genipap*. In British Guiana a bluish-black dye is prepared from the juice of this fruit.

GENISTA, *jen-is'-ta* (Lat., *genu*, knee, in allusion to the angular or jointed appearance of its twigs), a genus of leguminous plants, three species of which are found wild in Britain. *G. tinctoria*, the dyer's broom, yields a good yellow dye, or, when mixed with woad (*Isatis tinctoria*), a green.

GENTIANA, *jen-she-ai'-na*, the typical genus of the natural order *Gentianaceæ*. The gentian, so well known for its tonic properties, is the root of *G. lutea*, a native of the mountains of central and southern Europe. In medicine, gentian is administered as a compound mixture, as an extract, in the form of powder, and as an infusion. From gentian the Swiss prepare a spirit much prized by them as a stomachic. The genus is stated to have been named after Gentius, a king of Sclavonia, who discovered it. The plants included in the order *Gentianaceæ* are found in nearly all parts of the world, even in the coldest and the hottest regions. There are 64 genera and about 450 species.

GENUS, *je'-nus* (Lat.), in Zoology, a distinct group of species, allied by common characters and subordinate to an order, family, tribe, or tub-tribe. In Botany, the term *genus* is applied so a collection of species of plants which resemble one another in general structure and appearance, more than they resemble any other species. The characters of a genus are taken exclusively from the organs of reproduction, while those of a species are derived generally from all parts of the plant. It does not necessarily happen that a genus should contain a number of species; for if a single one presents peculiarities of a marked kind, it may of itself constitute a genus. The plural form of the word is *genera*.

GEOCENTRIC, *je-o-sen'-trik* (Gr., *ge*, the earth, and *kentron*, a point, centre).—An expression meaning having the earth for a centre, and applied to the position of a planet as it would appear to an observer stationed at the centre of the earth. It is opposite to the term *heliocentric*, which is used to denote a planet's position as it would be seen by an observer at the centre of the sun. *Geocentric latitude and longitude.*—The former is the inclination of the plane of the ecliptic of a line connecting a planet and the earth; the latter the distance on the ecliptic from the point of Aries to the point where the planet appears to be as seen from the earth.

GEODE, *je'-ode* (Gr., *gaiodes*, earthy, from *ge*, the earth), a term applied to a round lump of mineral, or to a mere incrustation of the same. Its interior is sometimes empty, and in that case the sides of its cavity are lined with crystals, as in agate balls. Sometimes it contains a solid movable nucleus, and sometimes it is discovered to be filled with an earthy matter different from the external envelope. Ruskin describes a geode as a "potato-stone."

GEODESY, *je-od'-e-se* (Gr., *ge*, the earth; *daio*, I divide).—That science which enables us by measurement and direct observation, to determine approximately the shape or figure of the earth, and ascertain the area of its entire surface, or any part of it, as well as the variations in the force of gravitation at different parts of the earth. (*See* EARTH.) If the latitudes and longitudes of places on the earth's surface, deduced from geodetic measurements, coincided with those obtained from astronomical observations, the form of the earth would be that of a regular spheroid of rotation; but there is such a difference in the results obtained by the two methods, that no regular shape can be assigned to the earth by which these results can be reconciled. (*See* ARC and MERIDIAN.)

GEOGNOSY. (*See* GEOLOGY.)

GEOGRAPHY, *je-og'-raf-e* (Gr., from *ge*, the earth, and *graphe*, a description), is that science by means of which we obtain a knowledge of this earth, both as it is in itself and as it is connected with a system of other similar bodies. It comprises a knowledge of its figure and dimensions; of the natural features, divisions, and productions of its surface; of the position of the various places upon it; and of its various inhabitants. It is usually arranged under three principal branches—Mathematical, Physical, and Political. *Mathematical Geography* deals with the earth principally in its planetary relations, as a member of the solar system; a great part of this being common to it with astronomy; and hence it is sometimes termed astronomical geography. (*See* EARTH, DEGREE, ECLIPTIC, LATITUDE, LONGITUDE, MERIDIAN, &c.) *Physical Geography* comprehends a description of the principal features of the earth's surface, as consisting of land and water, the different animal and vegetable products; climate, elevation and direction of mountain-chains, &c. (*See* PHYSICAL GEOGRAPHY.) *Political Geography* describes the countries and nations of the earth as they are politically divided, and deals with mankind in their social aspect and organization. It gives an account of the extent and boundaries, the population, the laws and government of the different countries, their language, religion, civilization, resources. These subjects are comprehensively treated in the First Division of this Encyclopædia, GEOGRAPHY, HISTORY, and BIOGRAPHY.

Progress of Geographical Science and Discovery.—The enterprising Phœnicians were the first to collect materials by the use of which an approximation to a knowledge of the configuration of the earth could be obtained. Phœnician mariners were familiar with the Euxine and the Mediterranean, and they penetrated into the great western ocean, and even visited the southern shores of the British Islands, before the 9th century, B.C., and the accounts of their voyages, however imperfectly recorded, must have stimulated a desire to obtain further information. Homer seems to have believed the world to have been a flat disc, including little more than the Greece with which he was acquainted, and the Troas where his heroes fought; but a hundred years later, Hesiod showed that Italy, Sicily, Gaul, and Spain, and even a considerable portion of Africa, were known with more or less accuracy by the Greeks of his time. Long before then the Assyrians, the Hebrews, and the Egyptians, must have had a general knowledge of the lands lying between the Euphrates and the Nile; but beyond them all was a blank. In the 7th century, B.C., Phœnician navigators are said by Herodotus—and there is strong evidence in favour of the authenticity of the statement—to have sailed round Africa, starting from the Red Sea and returning by way of the Mediterranean. Herodotus, styled "the father of history," contributed also largely to the knowledge of geography, by describing with considerable minuteness the various countries he visited in his travels. The expedition of Alexander into the hitherto almost unknown East, and the explorations undertaken by his order, made important contributions to geographical knowledge; and about the same time, Pytheas, a daring navigator, visited the eastern shores of England and reached northward as far, it is supposed, as Iceland, which he named Thule. The first attempt of Greek geographers in the way of geography as a science was to divide the earth into "climates;" but the results were necessarily unsatisfactory. A more practical method was the use of the *gnomon*, an upright post, by which the length of meridian shadows at various places was noted. Eratosthenes (who lived between 276 and 196 B.C.), who was acquainted with the sphericity of the earth, endeavoured to delineate the surface of the earth, so far as it was known, and even attempted to measure an arc of the meridian, and so ascertain the dimensions of the globe. About 170 years afterwards, Posidonius made another attempt to measure an arc of the meridian between Rhodes and Alexandria. There being no means of calculating longitudes, but only guesses of travellers as to distances, considerable errors were unavoidable. The earliest maps having anything of a practical character which have reached us are those of Ptolemy, the geographer of Alexandria, who lived in the second century of the Christian era. The Ptolemies of Egypt had greatly encouraged the study of geography; and considerable advance in the knowledge of the subject had been made by the Romans, under Julius Cæsar. A survey of the empire was undertaken and completed under Augustus. Pliny (born 23 A.D.), himself a traveller, collected all the information available from the best sources, the writings of Sallust, Cæsar, Tacitus, and others; and how much was really known is proved by his descriptions of the northern lands of Europe and allusions even to the Arctic regions, and his knowledge of the fact that Ceylon was an island and not, as was generally thought, a portion of a continent of which nothing further was known. After Pliny and Ptolemy so much extended geographical knowledge, the great landmarks of the history of geographical exploration were from the 14th to the 16th centuries. The travels of the Venetian Marco Polo, the discovery of the New World by Columbus, the passage round the Cape of Good Hope by Vasco de Gama; and the circumnavigation of the globe by Ferdinand Maghaelan. In the succeeding century, the coast of North America (some portions of which had been reached long before by Scandinavian adventurers), was explored, and the Arctic regions revealed by Frobisher, Willoughby, Davis, Hudson, Baffin, and others; between 1616, and 1624, the Dutch navigators discovered Australia, and Van Diemen's Land. Captain Cook's voyages, between 1768 and 1779, almost revealed the islands of the Pacific to the geographer; and since then a long series of indomitable explorers have penetrated Africa, Australia, Central Asia, and the frozen Arctic regions, and enabled us to map out, with considerable accuracy, the surface of the earth, while the advance in astronomical and mathematical knowledge, more extended acquaintance with the peculiarities of climate and the distribution of animal and vegetable life, has advanced in a corresponding ratio the science of physical geography.

Geographical Societies.—The Geographical Society of Paris was founded in 1821, by Malte-Brun, the eminent French geographer. The Royal Geographical Society of London was established in 1830.

GEOLOGY, *je-ol'-o-je* (Greek, *ge*, the earth; *logos*, discourse).—That department of natural science which refers to the structure of the earth, the nature of the matter of which the crust or outer cover of the globe is composed, and the forces which have operated to produce its present external aspect. It also includes the development and succession of animal and vegetable life as revealed to us by fossil remains found in the various strata of rocks. Geology is, indeed, the history of the earth, extending into pre-historic times, the chapters of which mark distinct epochs, each with peculiarities of its own, and each marked by a development of fauna and flora in a large number of instances different from those which now exist. The ancient history of the world must be studied in the rocks, deposited strata above strata, but disturbed by stupendous forces which have caused afterwards dislocations and marvellous changes in the aspects of the earth's surface. Sometimes the originally level strata have been depressed into curves, forming immense basins or valleys; sometimes they have changed from a horizontal to a perpendicular position, and the broken edges of the strata, the mass of which lies deeply buried beneath the present surface of the soil, present themselves to the view. Elevated districts, even very lofty mountains, have sunk below the level of the sea, and ages afterwards again risen, carrying on their summits the calcareous deposits of the ocean. Geological details must be studied in works especially adapted to the use of the student. The subject is too vast, the details too complicated and numerous, to permit us to indulge in more than a very brief notice of the fundamental principles of the science. What follows must be taken rather as an index than an exposition. Persons beginning the fascinating study—and scarcely any department of physical science has been found to be more attractive—may refer with advantage, among other works specially prepared for the purpose, to Professor Geikie's "Geology" in the "Science Primers," and Mr. David Page's "Text-books."

Rocks.—Rocks (a term which may be taken to include all kinds of natural stone, whatever may be its hardness or softness, and even clay, peat, and coal) may be divided into three great groups or classes having well-marked characters—*Sedimentary, Organic,* and *Igneous*.

1. *Sedimentary rocks* are those formed by deposits from water. The coarser and heavier the sediment, the more quickly will it sink; but when the sediment is composed of minute and comparatively light particles, it may be carried to a considerable distance by the stream before being deposited; and even in the case of gravel, the distance to which it is carried depends considerably on the velocity of the current of water. Gravel and sand differ only in respect of the size of the particles of which they are composed. The combined action of water and the atmosphere disintegrates rocks, and the fragments are carried onward by rivers and mountain torrents. The smaller fragments are ground by attrition into dust, or sand; the larger have their rough edges and angles smoothed away, and take the form of rounded pebbles. The heavier sediment, being first deposited, forms a layer of gravel; farther on a layer of the finer sand is formed, and, last of all, various substances, mostly of vegetable origin, sink to the bottom and form a layer of mud. In the course of ages, other layers are deposited, the stream being different in power in other places. Sand may cover the gravel of an earlier time, and mud may accumulate on the sand. As the deposits increase, the lower deposits are subjected to an immense pressure which hardens them into solid masses. The pebbles of the gravel are, as it were, cemented together, and form a rock known as conglomerate; the sand is also welded into a solid rock, to which the name sandstone is given; and the muddy sediment is converted into a rock known to geologists as shale. Rivers carry the greater part of

the rocks and other materials which they wash away to the sea, and there the various sediments are deposited, forming rocks. By the action of forces which we shall presently notice, these deposits become raised above the sea level, and form the rocks of which the dry land is afterwards made. There are undoubted evidences of the rising of the land in many well-marked sea-margins now high above the level of the ocean, and not unfrequently rising in terraces marking successive periods of elevation. The rocks thus brought to the surface are, like their predecessors, exposed to the action of water and the atmosphere, and the process is repeated and new rocks are formed beneath the sea. In masses of sandstone may be seen not only the ripple-marks made by the advancing and receding waves precisely like those so familiar to us on the sands on our own shores, but little pits or indentations made by the rain-drops at some very remote time. The sand, hardened into stone, was in course of time covered by other deposits, the result being an arrangement known as stratification (from Latin *stratum*, a layer). Shale and slate (both formed from mud deposits) and other rocks of a similar character are laminated (Latin, *lamina*, thin plate or scale), appearing to be formed by a series of plates placed one above the other. This is because there were successive deposits of similar materials, a long period elapsing between each, so that one had time to harden before the next was placed upon it. Continuous pressure united the successive layers into a mass; but they can now be readily split into separate plates. There is another agent by which sedimentary deposits are changed into solid rocks, and that is known as "infiltration." We avail ourselves of Professor Geikie's terse and lucid description of the two processes:—"When sand and mud are piled up over each other in wide sheets or layers to a depth of hundreds or thousands of feet, the layers at the bottom, lying under such an enormous weight, must be squeezed into a much firmer condition than those at the top. But, besides this, water is always filtering through pores and cracks of the rock, sometimes removing, sometimes depositing, mineral matters, and helping to cement the grains of many rocks more firmly to each other."

2. *Organic rocks* are so named because they originate in the accumulation of the remains of organized substances, vegetable and animal. The sediment deposited by water contains—besides gravel, sand, and mud—leaves, branches and stems of plants, shells and other remains of animals. These are found in the various layers of sediment, and when that is hardened into stone, the "fossil" vegetation, or animal, is embedded in the mass. Immense accumulations of shells, corals, and other animal matters are, by upheavels of the sea-bottom, brought to the surface, and form the chalk ranges and lofty cliffs with which we are all so well acquainted. Besides chalk, nearly all the limestones are composed of the remains of animals, as may be seen by the well-preserved coral, shells, "stone-lilies," and other similar relics. Larger fossils, those of huge and now extinct animals, will be more particularly referred to farther on. Among the most remarkable of the organic rocks are those which compose the carboniferous, or coal system. Coal is entirely a vegetable formation, composed of plants, with large forest trees among them, which at some remote period were, by changes of the earth's surface, buried beneath the sea and covered with deposits of sedimentary rocks. The immense pressure formed a compact mass of stratified matter (the thin layers of which a block of coal is composed are very apparent), and in course of ages a new vegetation appeared over the new soil, and passed through the same process of subsidence and transformation into coal. (*See* CARBONIFEROUS SYSTEM.) Geikie tells us that "in many parts of Great Britain the coal-pits are more than a thousand feet deep; and yet down at the bottom of each of these pits lies the coal-seam which we have found to be a buried swamp or jungle. If you could look at all the rocks which have been cut through in making the long shaft of the pit, you would usually find among them other coal-seams than the one at the bottom. In fact, several seams are sometimes worked for coal at different levels in the same pit." Peat-mosses, or bogs, may be taken to represent one of the steps in the formation of coal—vast accumulations of vegetable matter which have gradually filled up the basins formerly occupied by lakes, but which, not having been submitted to superincumbent pressure, have not been formed into hard, solid masses as the coal formations have been.

3. *Igneous rocks.*—Whether or not the interior of the earth is composed of mineral matter in a molten condition, it is certain that volcanoes in a state of activity pour forth igneous (that is, fiery) matter known as lava, which in course of time (sometimes where the mass is of enormous dimensions hundreds of years are required) cools and hardens into solid rock. This lava, when examined under a microscope, will be found to be made up of separate crystals firmly united, and masses of this nature form what are known as "crystalline" rocks. In some instances, the lava as it cooled assumed the form of columns, by contraction, the result being such an arrangement as may be seen at Fingal's Cave, in Staffa, or the Giant's Causeway, in Ireland. Another kind of igneous rock is granite, which has not been thrown to the surface by volcanic action, but which has cooled and crystallized beneath great masses of other rocks. Granite is described as "a stone composed of distinct crystals not laid down in layers, but irregularly interlaced with each other." The crystals are those of felspar, mica, and quartz. (*See* headings.) Although formed deep down in the lower part of the crust of the earth, so powerful are the forces at work that granite is now found in the form of huge mountains, many of the loftiest summits in Scotland, and some of the Alpine heights being masses of granite. Rocks of igneous origin are not only found in elevated positions as just described, but are met with forming strata interposed between other rocks, or in vertical positions, interrupting, as it were, other strata. Geologists describe the different appearances in this manner. The igneous rocks present themselves on the crust of the earth as disrupting, interstratified, or overlaying masses, or in detached blocks or *boulders*. When the molten mass has forced its way through the stratified rocks and filled up rents and fissures, it is *disrupting*; when having passed through the strata, it has spread over the surface in sheet-like masses, it is *overlying*; when the discharges have taken place at the bottom of the sea, and has been in turn covered over by new deposits of sediment, then the igneous rocks are *interstratified* with the sedimentary rocks. Isolated masses of granite, or "boulders," are found at great distances from any other granite formation, and frequently deposited at considerable elevations, their position being due to glacial action, described farther on. There is another group of igneous, or rather volcanic rocks, formed by the dust, sand, and stones, cast up into the air during an eruption, and forming immense deposits, in some cases covering many miles around the base of the volcano. It was a shower of this kind that burned the cities of Pompeii and Herculanæum. In the course of time this deposit hardens into a solid rock, known as "fragmental," being composed of irregularly shaped fragments of various kinds of stone, and of all sizes from the finest dust up to blocks of great size. The name "Volcanic tuff," or "tufa," is given by some geologists to this rock. When the volcanic discharge fell into the sea, it covered up the remains of plants or animals which might be lying there, and when, in course of time, the sea bottom was upheaved the "tuff" rocks were found to contain shells and other marine organisms. Igneous rocks do not present a succession of layers or strata, but appear in "amorphous" masses (Greek, *a*, without, *morphè*, form, or shape), that is, of no regular or determinate form.

These are the three classes, sedimentary, organic, and igneous, into which most rocks may, with tolerable distinctness, be divided; but there are *metamorphic* rocks—that is, rocks which have undergone a change. The oldest of the rock systems, originally sedimentary, are very different from the silt and mud, the sand and the gravel, and the shell and coral rocks of later formations The difference, however, is one of conditions rather than of composition. Deeply buried in the earth under newer sediments, the Laurentian rocks have been "baked," until sandstones, gravels, and clays have become crystalline, as gneiss, mica-schist, horneblende-schist, and in other forms, showing at first sight no resemblance to the original material, except in the regularly stratified and bedded arrangement which seems to distinguish them from igneous rocks.

Disturbing Forces.—From a superficial view of the subject, it might appear that the strata, if deposited as described, would appear in regular succession, but we find that they are disturbed and distorted in the manner described at the commencement of this article. One of the most powerful of these forces is the shrinking of the earth during the process of cooling. Under the enormous strain of contraction, the outer crust—that is, the solid matter which envelopes the fiery interior—is broken up into ridges with wide depressions between. These ridges are the mountain ranges, and the sunk spaces are the seas and oceans. Geikie describes these ridges as "the folds or puckerings of the earth's surface." Another powerful force is volcanic action, which upheaves the surface in some places and causes depression in others. Sea-bottoms become table lands, and lofty mountains are sunk beneath the waves. "By volcanic forces," says Mr. Page, "stratified rocks are broken up, lose their horizontality, and are thrown into positions more or less inclined and irregular—may be thrown on edge, subside into lower formations, or be bent and contracted in a most fantastic manner." The angle or slope at which a stratum inclines to the horizon is called the *dip;* when an inclined stratum comes to the surface, its edge is called the *outcrop.* It is often observed that a stratum of one kind of rock appears to end abruptly; but that at a considerable distance another stratum of the same rock appears at a different level. This is particularly observable in coal-mines, where the seams of coal are, as it were, disjointed. Again, on the opposite sides of gorges and deep valleys, there is a correspondence between the geological formations, although a depression of considerable breadth intervenes. These gaps are known as "valleys of dislocation." The fact is that the continuous strata have been broken by volcanic action. When an earthquake or volcanic shock is unaccompanied by discharges of igneous matter, the fissures will simply be *slips,* or *faults;* when accompanied by igneous discharges, the molten matter will force its way through and fill up the fissures, producing *dykes;* and when the rents are, by the percolation of water, subsequently filled up by the slow infiltrations of mineral and metallic matter, the result will be *lodes* and *veins.*

Climatic Changes.—There can be no doubt that at different periods in the history of the earth, there were marked differences of temperature. Professor Geikie tells us, "Once a great part of this country, as well as of Europe and North America, was buried under ice like Greenland. Earlier still, it had jungles of palms and other tropical plants; yet further back, it lay beneath a wide deep ocean; and beyond that time can be traced many still more remote periods, when it was forest-covered land or wide marshy plains, or again buried under the deep sea." The glacial, or ice-covered period is supposed to have almost immediately preceded the period in which the temperate regions of the earth assumed their present general appearance, and the existing fauna and flora sprang into existence. Most geologists are now of opinion that our continents were, even in what are now the temperate latitudes covered with a sheet of ice; and about the same time occurred a very general subsidence, in which they were submerged under the water of a cold icy sea, tenanted by marine animals now found only in arctic regions. After this they rose and contributed the dry land of man and the contemporary animal world. Traces of the movements of glaciers of enormous extent are easily discernible in the "striations" or scratches which mark the course they took. The glaciers now existing in the Alps, Greenland, and other parts of the surface of the earth, show the action of these prehistoric glaciers. The rounded summits of many mountain ranges show the wearing action of the ice on the rocks; and the enormous masses of granite and other hard rock found in isolated situations were broken off by the moving glaciers, and when the ice melted, left where we now find them, the action being exactly that observable to-day by which "moraines," huge blocks of stone, are deposited in the Alpine valleys.

Fossils.—Every great change in the surface of the earth by which old strata were submerged and new strata deposited, must have buried in the formations the animals existing at that time. Consequently we find in most of the sedimentary and cretaceous rocks fossilized skeletons and fragments of many animals, some similar in general organization, others differing largely in scale, from existing animals; and others bearing scarcely any resemblance. Many of them are of dimensions which no living creature now attains, proving that, under other conditions, living organisms possessed characteristics differing from those of their successors. The earliest traces of organic life are found in the Cambrian and Silurian strata—compound polyps, trilobites, cephalopods, corals, and the earliest forms of fishes. In the Devonian (old red sandstone) are corals, shell-fish, sea-lilies, the first land plants, especially cryptogamia, and the first pine. In the carboniferous formation are molluscs, reef-forming corals and fishes, ferns, reeds, mosses, annularia and coniferæ. The Permian strata reveal the first reptiles and insects, mussels, insects, and fishes; tree ferns, fossilized forests of palms, grasses, and coniferæ. In the Triassic formations are saurian frogs, crustaceæ, cephalopods, snails, mussels, crocodiles; and calamites, and a few endogenous plants. The first remains of mammals appear in the bone beds between the Triassic and Jurassic formations. In the Oolitic strata appear the gigantic saurians (ichthyosaurus and plesiosaurus), marsupials, sponges, first vertebrate fish, tortoises, pterodactyl (flying lizard), the first traces of a bird, and sea-weeds. Between these strata and the chalk formation is the great saurian, the iguanodon; and in the chalk, foraminiferæ, sponges, crustaceæ, worms, ferns, palms, pines, the first dicotyledons, and many large leaved trees. In the Eocene (in Central Europe) a genuine tropical flora; and in the upper strata, the first great mammal fauna, proboscidians, edentata, insect eaters, and apes. Amber, with its many insect enclosures, belongs to this period. The second great mammal fauna, including the mastodon and dinotherium, are found, besides the horse, cat, hyena, and ape. In plants, there is a prevalence in Europe of what are now known as American types. Palms, acacias and mimosas have disappeared, and there is an abundance of willows, poplars, and maple. Then followed the glacial period, succeeded by our present flora and the great mammals, the mammoth, cave-bear, giant elk, auroch, and rein-deer, some of which survive: and at length man appears upon the scene.

Geological History of the Earth.—We obtain an insight into this wonderful record by studying the successive beds of rock which have been deposited on its surface, and the masses which have been forced up in a liquid state from within the crust of the earth, together with the fossil remains of animals and plants which certain of its beds contain. This geological period is usually divided into four great periods, the names of which are taken from the progress of animal life, as this at present affords one of the best criterions for geological classification. The periods are the Eozoic (from Greek, *eos,* the dawn; *zoe,* life), "period of the dawn of life;" the Palæozoic (*palaios,* ancient), "period of ancient life;" Mesozoic (*mesos,* middle), "middle period of life;" and Neozoic (*neos,* new), "recent period of life." Each of these periods is subdivided as shown in the following tabular arrangement. All the principal systems and groups are described under the respective headings (which *see*).

NEOZOIC, OR CAINOZOIC (*kainos,* ancient).
 Post Tertiary or *Quaternary*—
  In progress.
 Tertiary—
  Pleistocene (*pleistos,* most; *kainos,* recent).
  Pleiocene (*pleion,* more).
  Miocene (*meion,* less).
  Eocene (*eos,* dawn), the earliest tertiary deposits.
MESOZOIC.
 Cretaceous—
  Chalk.
  Greensand.
 Oolitic, or Jurassic—
  Wealden.
  Oolite.
  Lias.
 Triassic—
  Saliferous marls.
  Muschelkalk (German, shell limestone)
  Upper new red sandstone.
PALÆOZOIC.
 Permian—
  Magnesian limestone.
  Lower new red sandstone.

Carboniferous—
Coal measures.
Millstone grit.
Mountain limestone.
Lower coal measures.
Old red sandstone (*Devonian*)—
Yellow sandstones.
Fossiliferous limestones and slaty shales.
Red conglomerates, sandstones, and corn-stones.
Grey sandstones, flags, and conglomerates.
Silurian—
Upper, shales and limestones.
Lower, grits and flags.
Cambrian—
Upper slates and flags.
Lower slates and grits.
Laurentian—
Upper, or Labrador series.
Lower, or Laurentian.
Eozoic—
Metamorphic—
Clay slate.
Mica-schist.
Gneiss and granitoid schist.

Geological Time.—Geologists estimate the age of the known strata by periods of immense duration, extending over millions of years, drawing their conclusions chiefly from the time required to deposit the sedimentary rocks and the thickness of the various strata. There is, however, considerable difference of opinion among scientific geologists, and at the best only vague estimates can be arrived at.

History of Geology.—So early as the times of Pythagoras and Strabo, some speculations were indulged in as to the structure of the earth and the effects of volcanic actions and the changes in the level of sea and land were noticed. About the 16th century, the nature of fossils was the subject of inquiry. Some suspected that they were remains of animals, but the majority regarded them as freaks of nature. When, at length, about two hundred years later, organic origin was established, the Deluge was accounted to have been the cause of their deposit. Leibnitz, in 1680, suggested that the earth was originally in a molten condition, that the rocks were formed by the cooling of the surface, which condensed the surrounding vapours and produced the ocean, the subsidence of which from the cooling of the crust of the earth produced the sedimentary strata. Hutton, about 1788, laid the foundation of the science as now accepted.

GEOMETRY, *je-om'-e-tre* (Gr., *geometria*, *geo*, the earth, and *metreo*, I measure), may be strictly defined to be the doctrine of the extension of such things as lines, surfaces and solids. The attributes or properties of bodies may, in order to be more readily explained, be resolved into two classes, one comprising the general characteristics of all, and the other such only as are included in particular or peculiar bodies. Extension, figure, magnitude, mobility, divisibility, impenetrability, weight, and inertia, may be mentioned as some of the properties which belong to the first class; whilst some of those in the second are solidity, liquidity, transparency, and such-like. Of all these properties mentioned, only *extension*, *magnitude*, *figure*, and *divisibility*, come under the special branch of science denominated Geometry; the different properties which remain coming under the head of Natural Philosophy, or Physics. All notions of geometrical magnitudes are obtained by means of contemplating a body or solid, which is extended in three different forms; that is, in length, in breadth, and in thickness. The outside boundary of a solid which separates that particular portion of space which it occupies from space in general, is termed the surface, or superficies—that is, the external area; and a surface cannot be considered as possessing any other qualities except length and breadth. Solids, surfaces, and lines, therefore, are the subjects of geometrical investigation and discussion. There is no limit whatever to the number of these surfaces, solids, and lines which may be considered in this science. The elements of geometry, however, are restricted to a few, which include straight lines, circles, rectilineal plane figures, and their consequents, which constitute one branch of the science; and solids, bounded by planes, and the cylinder, the cone, and the sphere, all of which are formed by the intersection of planes, and which go to make up the other portion of the subject. Geometry is, consequently, divided into two branches, one of which treats of figures on a plane, the other of the formation and ramification of solids. The fundamental axioms on which the science is based may be said to be six in number. 1st. Two quantities, each of which is equal to a third, must be equal to one another. 2nd. The whole of anything is greater than a part of the same. 3rd. The whole of anything is equal to the sum of its parts or sub-divisions. 4th. Only *one* straight line can be drawn between any two points. 5th. Two magnitudes, whether they are lines, surfaces, or solids, are equal, if, when applied to one another, they exactly coincide, or fill the same space that is. 6th. All right angles are equal to one another. The application of these axioms; and the foundations of others, are laid down in the first and second books, whilst the proportions of the circle occupy the third and fourth books, of "Euclid's Elements."

Geometrical Definitions.—A *point* has position, but no magnitude, and a *line* possesses only length: hence points and lines are closely allied; as the termination of every line, and the intersection of one line with another, must always be a point. A *straight line*, or *right line*, as it is termed in Geometry, is always the shortest way from one point to another. Every line, which is neither straight nor composed of straight lines, is a *curve line*. A *superficies* has only length and breadth; and, consequently, the extremities and intersections of superficies are always lines. A *plane superficies* is that in which any two points being taken, the *right line* drawn between them lies wholly in that superficies. Every superficies which is neither a plane, nor composed of plane superficies, is termed a *curve superficies*. A *solid* has length, breadth, and *thickness*; hence the boundaries of all solids are superficies, and the contiguous boundary to two solids which are connected is also a superficies. A *plane rectilineal angle* is the inclination of two straight lines to one another which meet at one point, but are not in the same straight line. The point of meeting between them is called the *vertex* of the angle. Angles, in common with other quantities, admit of addition, subtraction, multiplication, and division. When one straight line erected on another straight line makes the adjacent right angles equal to one another, then each of the angles thus formed is a *right angle*, and has 90 degrees; the line which makes them with the *base* is termed the *perpendicular*. An *obtuse angle* is that which is greater than a right angle; and an *acute angle* is less than a right angle. *Parallel straight lines*, which are in the same line, are such as, when produced, can never meet. A *plane figure* is a plane terminated everywhere by lines; if the lines are straight, the space they enclose is termed a *rectilineal figure*, or *polygon*, and the lines themselves are termed the *perimeter* of the same. When this polygon has three sides (the least number it can possibly have), it is called a *triangle*; when four, a *quadrilateral*; when five, a *pentagon*; and so on. An *equilateral triangle* is that which has three equal sides; an *isosceles* triangle has two sides equal; and a *scalene* triangle has all three sides unequal. A *right-angled* triangle has a right angle, and the side of the triangle opposite this angle is called the *hypothenuse*. An *obtuse-angled* triangle has an obtuse angle, and an *acute-angled* triangle has an acute angle. Among quadrilateral figures, a *square* is that which has its four sides all equal to one another, and all its angles *right angles*. A *rectangle* has all its angles right angles, but its opposite sides only are equal. A *rhombus* has all its sides equal, but its angles are not right angles. A *parallelogram*, or *rhomboid*, has its opposite sides parallel and equal; and a *trapezoid* is a figure which has only two of its opposite sides parallel. The straight line which joins the vertices of two angles which are not adjacent to each other is called a *diagonal*. A polygon which has all its sides equal, is called an *equilateral* polygon; and if the angles are all equal, it is called an *equiangular* polygon; if both the angles and the sides of the polygon be all equal, it is called a *regular* polygon.

Geometrical Terms and Signs.—An *axiom* is a proposition the truth of which is evident at first sight to the observer; a *theorem* is a truth which has been demonstrated or reasoned; and a problem is a question proposed which requires solution; a *lemma* is only a subsidiary truth employed in the solution of a problem or the demonstration of a theorem; a *corollary* is a consequence which follows the theorems of one or several propositions or problems solved; a *scholium* is a remark made upon one or more preceding propositions and it tends to show the application, the restriction, or the extension of the same, an *hypothesis* is a supposition made in order to effect more easily the demonstration or enunciation of a problem or theorem; and, lastly, the term *proposition* is applied generally to problems, theorems, and lemmas. The signs used in geometry are the same as those in algebra.

History of Geometrical Science.—Herodotus dates the origin of geometry as a science from the following circumstance:—Sesostris, the king of Egypt, shared the lands at Thebes and Memphis between his subjects, and each portion was marked out by different landmarks; but, owing to the inundations of the Nile, these boundaries were frequently destroyed, and it became necessary, as often as this was done, to restore them by measurement; hence a system was invented which was termed geometry. This statement is not very authentic; but it is more certain that Thales, a philosopher who lived some 640 years before Christ, brought the science into Greece from Egypt, whither he had, it is related, gone in search of knowledge at rather a late period in life. After Thales came Anaximander, who is said to have invented geometrical charts and the sphere and gnomon; next followed Anaximenes, who invented the sun-dial, and must thus have been acquainted both with astronomy and geometry. Pythagoras instituted the theory of regular solids; and under his school it was improved gradually during the two centuries which elapsed after the introduction of geometry, until the school of Plato took it in hand. The theory of conic sections dates its birth from the Platonic schools, and to the same source may be ascribed the method of geometrical analysis. The school of Aristotle cannot be said to have done much towards the forwarding and improvement of geometry, although one of the writers of the same period has transmitted to us the only written accounts we possess; Eudemus having written a history of geometry in six books. The school of Alexandria is undoubtedly the first grand starting-point of geometry: it is justly celebrated in general history, but in mathematics its importance can hardly be over-rated. The school was founded shortly after the death of Alexander, when the vast empire which had been built up by that conqueror was dismembered, and the greater portion of it fell to Ptolemy Lagus, who established his capital in Egypt. His wealth and encouragement, coupled with the disturbed state of their homes, induced many of the Greek philosophers to place themselves under his protection; and amongst these was Euclid, who is entitled to one of the highest places in the history of geometry. Euclid's Elements are the foundation of the science, and all modern geometry is composed only of variations on his well-known theorems, axioms, and deductions. The writings of Archimedes are likewise most important; and although they are less studied in the present day, on account of their being less elementary than Euclid, yet they should be carefully conned by every mathematician, as they give a keen insight into the workings of ancient geometry—more so, in fact, than Euclid. The study of the mathematical sciences declined considerably in the 1st century of our era, but it regained its supremacy during the 2nd. Menelaus wrote on trigonometry and spherical geometry; and his work on the same reached us by means of a translation from the Arabic, which is in existence at the present day. From the 2nd century up to the 8th, geometry again languished considerably, and it was then taken up by the Arabians, as the Greeks had neglected it. It is from the Arabians, in fact, that some of the books of Euclid have been preserved for the benefit of science in general. The Persians have also possessed their geometricians, the most distinguished of whom was Nassir-Eddin al Tussi, who wrote a commentary on the great Euclid, which was published in Italy in the year 1590. Geometry remained quiescent from the 8th century to the 17th, when it was again taken up with a similar zeal as that by which it was prosecuted in the old Greek empire. Lucas Valerius, an Italian, was the first who gave it his serious consideration; and his researches led him beyond the timeworn pathway in which his predecessors had been contented to work. He selected a subject which Archimedes seemed to have forgotten—namely, the centre of gravity in solids, and he carried out his purpose in a very satisfactory manner. In England, geometry, or the spirit of it, seemed now to have been imbibed; and Robert Record was the author of the first book on the subject printed in this country, entitled the "Pathway of Knowledge;" Edward Wright, another geometrician, was the inventor of the "Mercator's Chart." Kepler was the first of the moderns, however, who thoroughly understood and enlarged his subject. He opened one of the unexplored pathways of science which had long been closed—that of introducing the notion of infinity into science. The views of Kepler were eagerly adopted by Roberval and Cavalieri, and the earnest investigations of the three led to a fruitful harvest of discovery. The theory of tangents of Fermot, the differential calculus of Leibnitz, and the fluxional theory of Newton (*see* article on FLUXIONS), may be traced as consequences to the new views of Kepler. Guildin, a Jesuit, discovered the centre of gravity applicable to the measurement of solids formed by revolution; Galileo first suggested the *cycloid;* James Gregory was the author of the logarithmic curve; and Leibnitz showed the two properties of the catenary. Before the time of Newton, pure geometry and algebra were the only subjects on which mathematical students could exercise their genius; but his great and sublime discoveries opened a vast field for new studies. The fact of the orbits of the planets being in the form of ellipses, naturally connected their motions with the theory of conic sections; and this is ably pourtrayed in Newton's "Principia."

GEOMETRICAL MEAN.—The mean of two numbers is that number the square of which is equal to the product of the two numbers. It is found by multiplying the two numbers together, and extracting the square root of the product. Thus the geometrical mean of the two numbers 5 and 20 is 10, because $5 \times 20 = 100$, the square root of which is 10.

GEOMETRICAL PROGRESSION.—A series of quantities each term of which is equal to that which precedes it, multiplied by some factor which is the same for all the terms. Thus, employing 4 for the multiplying factor, we can have, in geometrical progression—2, 8, 32, 128, and so on to any extent.

GEORGIA BARK. (*See* PINCKNEYA.)

GEOTEUTHIS, *je-o-teu'-this.*—A genus of fossil catamaries, found only in formations of the Oolitic periods, resembling in some respects the cuttle-fish.

GERANIUM, *je-rai'-ne-um* (Gr., *geranos*, a crown), the typical genus of the natural order *Geraniaceæ*, or Crane-bill family. The species are chiefly European plants, in many cases being mere weeds of no interest, and in others being extremely showy border-flowers. The favourite plants called geraniums do not belong to this genus, but to the genus *Pelargonium* (which *see*). The root *G. maculatum* is a powerful astringent, and is much used medicinally in North America, where it is called alum-root. *G. parviflorum* produces edible tubers, which are known in Van Dieman's Land under the name of native carrots.

GERANIUM OIL. (*See* ANDROPOGON.)

GER-FALCON, OR JER-FALCON, *jer'-fawl-kon* (Fr., *gerfaut*) (*Falco Gyrfalco*), a species of falcon, considered as the boldest and most beautiful of the tribe. In size it approaches closely to that of the osprey. Its general colour is brownish-grey, of varied tints above and white beneath, with brown longitudinal spots, but one variety is entirely white. The tail is crossed with a number of deeper and lighter bands, and the bill and legs are usually of a pale blue or yellowish colour.

GERHARDT'S NOTATION, *zher-hardtz'*, a method of expressing chemical formulæ, proposed by an eminent French chemist, M. Charles Gerhardt, and differing from that in general use by the doubling of certain equivalent numbers. This system, which, at first, was somewhat slighted, has gained ground in a remarkable manner, and in this country it has been used for some time, both in teaching and writing, by eminent chemists. M. Gerhardt doubles the equivalent numbers of oxygen, sulphur, carbon, selenium, and tellurium, on the assumption that *equal volumes of elementary gases and vapours contain the same number of atoms when compared under similar conditions of heat and pressure;* which is equivalent to saying that an atom of oxygen weighs sixteen times as much as an atom of hydrogen, because a cubic foot of the former gas weighs sixteen times as heavy as a cubic foot of the latter. According to this new system, therefore, the equivalents of oxygen, carbon, sulphur, selenium, and tellurium are doubled. Besides the change in the equivalents, Gerhardt revived and fully carried out a theory of the constitution of acids and salts, first propounded by Sir Humphrey Davy. From numerous anomalies, occurring chiefly in organic bodies, Gerhardt came to the following conclusions:—1. That every uncombined acid necessarily contained one or more equivalents of hydrogen. 2. That the bodies hitherto regarded as dry acids possessed no acid properties until united with hydrogen and oxygen. 3. That salts were formed by the substitution of one or more atoms of hydrogen, by one or more atoms of a metal, or some substance acting as such. Gerhardt also originated the system of arranging compounds according to types, and fully worked out the theory of the formation of all bodies by the substitution of one element or group of elements by others of a similar character.

GERMINATION, *jer-min-ai'-shun* (Lat., *germino*, I sprout), the beginning of vegetation, or the development of the embryo into an independent plant, capable of supporting itself. (*See* ROOT, SEED, SPORE and STEM.)

GEROPIGIA. (*See* JERAPIGIA.)

GERVAS, *jer'-vas.*—A small shrub (*Stachytarpheta Jamaicensis*) of the natural order *Verbenaceæ*. It is a native of the West Indies. The leaves are used as a substitute for tea, and also for the purpose of adulterating tea.

GESNERACEÆ, *ges-ne-rai'-se-e* (after Gesner, the naturalist), the *Gesnera* family, a natural order of *Dicotyledones*, sub-class *Corolliflorœ*. They are herbs or soft-wooded shrubs, and are chiefly natives of warm or tropical regions. On account of the beauty of their flowers, they are much cultivated in this country. There are about 120 species.

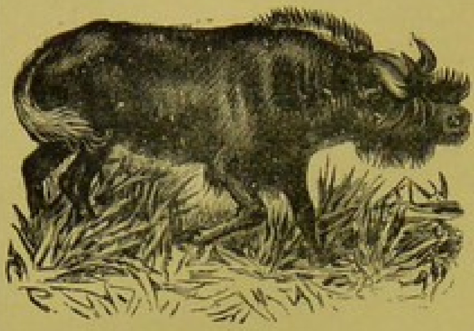
GESTATION, *jes-tai'-shun* (Lat., *gestatio*, from *gero*, I carry).—A term applied to the period which intervenes in the mammalia between the time of conception and that of delivery. This period differs greatly in different animals. In the human species it is nine calendar months, or, more strictly, forty weeks, or 280 days; but by certain circumstances the period may be prolonged or shortened by several weeks; and sometimes the birth takes place as early as the seventh month. In the cow the period of gestation is nine months, in the mare eleven, in the dromedary twelve, and in the elephant twenty-one. In the smaller animals it is much less; being in the dog about sixty-three days, in the cat fifty-six, the rat twenty-eight, in the sow four months, and in the sheep and goat about five.

GEUM, *je'-um* (Lat.), a genus of the natural order *Rosaceæ*. The most interesting species is *G. urbanum*, the wood avens, a common herb in our hedges and thickets. The roots have an aromatic flavour, something like that of cloves. They were formerly much used for flavouring ale, and to some extent in medicine, for their tonic and astringent properties.

GEYSER, *gai'-ser* (Icelandic, *geysa*, to burst forth).—A name given in Iceland to thermal springs, which give forth eruptions of hot water. The jets are of various sizes, some only about an inch in diameter; but the Great Geyser is a pool of hot water about 70 feet in diameter and four feet deep, with a pit in the centre six feet deep and eight feet wide. At intervals of a few hours, jets of water, almost at the boiling point, are violently thrown off, and about once a day the water is thrown to a height of nearly 80 feet, accompanied with clouds of steam. Another geyser, known as the Strokr (churn), is nearly as large, and also gives forth lofty jets, but at irregular intervals. The spring first broke out in 1784, at the time of a great earthquake. The Little Geyser is in a separate group of hot springs, 36 miles from those mentioned, and throws out water to a considerable height about six times every twenty-four hours. Similar geysers, known to the natives as *puia*, are numerous in New Zealand, especially in the valley of the Waikato river.

GHOST MOTH.—A species of moth (*Hepialus humuli*), which generally flies in the twilight, and appears to prefer lonely places. It is white, and has a habit of suddenly folding its wings so that it appears to vanish in the fading light. The caterpillar, commonly known as the Otter, and very destructive in hop plantations, is yellowish white and nearly two inches long.

GIANT, *ji'-ant* (Fr., *géant*, from *gigas*, the Latinized form of a Greek word, probably formed from *ginesthai* and *ge*, signifying "the earth-born"), an individual of extraordinary stature and bulk. In most of the cases where the existence of giants has been based upon the discovery of colossal bones, it has been afterwards discovered that the remains were not those of human beings, but of extinct quadrupeds. Among classical writers, statements respecting giants are numerous, but not worthy of belief. Coming to more reliable evidence, it seems certain that a height of even more than



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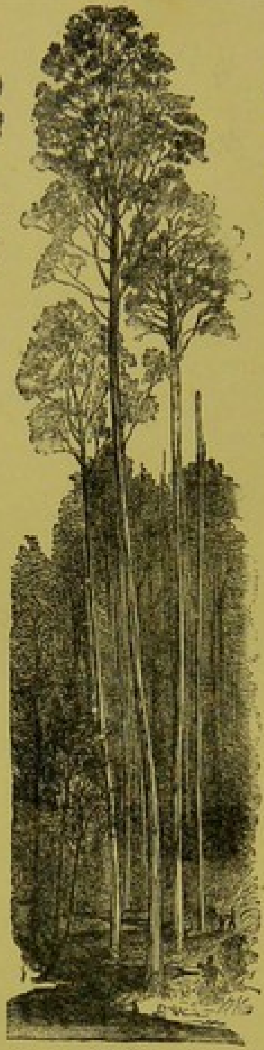
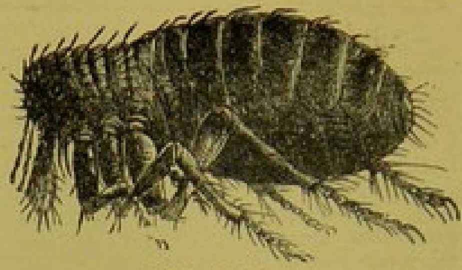


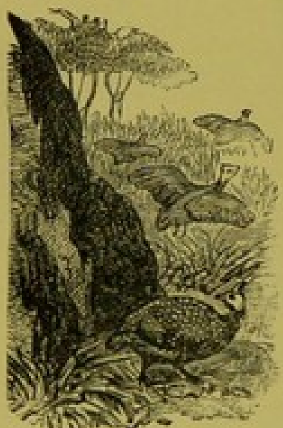
GUM-TREES.



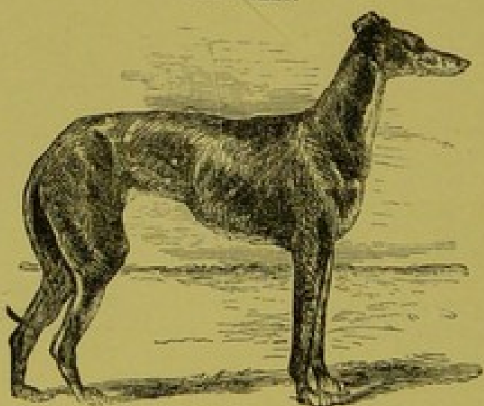
FLEA, MAGNIFIED.

GAMBOGE.

GINGER.



GUINEA FOWL.



GREYHOUND.

GOSHAWK.

GAVIAL.

nine feet has been attained. In the museum of Trinity College, Dublin, there is a skeleton 8 feet 6 inches in height; in the museum of the College of Surgeons of England, is another 8 feet 2 inches; and another in the museum at Bonn, 8 feet. As a general rule, giants are of rarer occurrence than dwarfs; they are usually of a lymphatic temperament, of a delicate complexion, often deformed, and generally badly proportioned. Their muscles also are flabby, and their voices weak. They are seldom long-lived, and in this respect are the reverse of dwarfs. It has also been observed that giants show a want of activity and energy both in body and mind, while dwarfs are usually lively, active, and irascible.

GIBBON, *gib'-bon.*—A genus of apes, or tailless monkeys (*Hylobates*), nearly allied to the orangs and chimpanzees, but much smaller and distinguished by the extraordinary length of arm. They live chiefly in forests, swinging with great activity from branch to branch, but moving awkwardly and slowly on the ground. They are natives of India and the Eastern Archipelago. One species (*H. albimana*) in Sumatra has white hands, the rest of the body being black. All the gibbons are easily domesticated.

GIBBOSITY, *gib-bos'-e-te* (Lat., *gibbositas*, from *gibbus*, a swelling or protuberance).—A hump or other irregularity or swelling on the back, or any other part of the body, arising from disease of the spinal column.

GIBBOUS, *gib'-bus* (Lat., *gibbus*, hunched, humped), an expression applied to the convex or protuberant shape that the moon presents in its second and third quarter, before attaining the perfect circular form that it exhibits when it is full.

GIBEL, *gi'-bel.*—A small fish (*Cyprinus gibelio*), of the same genus as the carp, but easily distinguished by the absence of barbules at the mouth. It is generally known in this country as the Prussian carp.

GIDDINESS, *gid'-de-nes* (Sax., *gidig;* Lat., *vertigo*, from *verto*, I turn), a dizziness or swimming of the head, with more or less of mental confusion, and a loss of power to balance the body. It generally comes on suddenly, and is symptomatic of various diseases, arising, as it does, from some disturbance or debility of the nervous power. It not unfrequently arises from some organic disease of the brain or heart. Most frequently, however, it arises from indigestion, and may be got rid of by means of some aperient medicine.

GILLENIA, *gil-le'-ne-a*, a genus of the natural order *Rosaceæ*. *G. trifoliata* and *stipulacea* are pretty North American plants, with lobed, discoloured leaves and white flowers. They are about two feet high, and the foliage is very graceful. The roots of both species are used medicinally, and are commonly known under the names of Indian physic and American ipecacuanha. In small doses they are tonic; in larger doses, emetic.

GILLIESIACEÆ, *gil-le-se-ai'-se-e* (after Dr. Gillies, of Conception, in Chili), the *Gilliesia* family, a natural order of *Monocotyledones*, subclass *Petaloideæ*, consisting of small herbaceous bulbous plants, with grass-like leaves and spathaceous flowers. There are but two genera—*Gilliesia* and *Miersia*, containing five species, all natives of Chili.

GILLS, *gilz* (Swedish, *gel*), a term applied to the apparatus possessed by all fishes, by means of which their respiration is effected exclusively through the medium of water. The gills, or branchiæ, are situated on each side of the neck, and are composed of several laminæ fixed on arches. These laminæ are covered with a vast number of minute blood-vessels, and are so formed as to present a considerable surface to the water, so that a sufficient portion of oxygen may be received by the blood. As the oxygen is continually being removed, the water becomes deteriorated, and it is consequently necessary that a constant current should flow over them. This is effected in most fishes by their taking the water in at the mouth and expelling it under the gill-covers in regular respirations.

GINGER, *jin'-jer.*—A genus of perennial herbaceous plants (*Zingiber*) of the natural order *Zingiberaceæ*, natives of the East Indies, but cultivated in other tropical countries. The root stocks of most of the species, especially the Common Ginger (*Z. officinalis*), are used as a condiment and in medicine. The valuable qualities depend upon a volatile oil of a pale yellow colour. The young root-stocks, preserved in sugar, and known as candied ginger, are a choice sweetmeat. Syrup of ginger and essence of ginger are used for flavouring.

GINGKO, OR GINKO, *ging'-ko.*—A tree of the natural order *Taxacea*, in some respects similar to the yew, and named *Salisturia adiantifolia*, a native of China and Japan, but is now grown in many parts of Europe. It is a tall tree, with a conical head. The wood, of a yellowish colour, is easily worked. The fruit has a farinaceous kernel, with an almond flavour, cooked and eaten in China and Japan.

GINSENG, *jin'-seng.* (*See* PANAX.)

GIRAFFE, *je-raf'* (Arab., *zarifa*).—This animal, *Camelopardalis Giraffa*, is the tallest of quadrupeds, and the largest of the Ruminant order. It is a native of Central and Southern Africa. In points of resemblance, the giraffe approaches the deer, the antelope, and the camel; and, besides this, has many singularities about it which are especially its own. In the length, slenderness, and flexibility of its neck, it surpasses all other quadrupeds, and peculiarities of conformation adapt it eminently for the life which it leads on the sandy desert. Its head resembles that of the camel, from the absence of a naked muzzle, and in the shape and organization of the nostrils, which are oblique and narrow apertures, defended by the hair which grows at their margins, and surrounded by cutaneous muscular fibres, by which the animal can close them at will. This is a beautiful provision of nature for the defence of the air-passages and the irritable membranes lining the olfactory cavities, from the fine particles of sand which the storms of the desert raise up and whirl about in suffocating clouds. The eyes of the giraffe are so placed as to take in a wider range of vision than those of any other quadruped, and it is thus able to see an enemy in the rear as well as in the front when its head is elevated during the time that it is browsing on its favourite acacia plant. The weapons by which it defends itself are its horns and its hoofs. The former it does not wield by *butting*, as is the case with other *Cervidæ;* but swings round with a lateral movement of the neck, and hits with them sideways: the latter are very powerful; and sometimes a giraffe has been known to prostrate a lion with a single kick. Its motion in progressing is most peculiar; travelling, as it does, in a sort of crab-like movement. It lifts both its hind and fore legs on each side of the body together, and its appearance when cantering is peculiar in the extreme. The tongue is formed to suit its habits of life, and is used to hook down the branches of trees which grow beyond the height at which its muzzle can reach. The two horns with which it is provided are peculiar to both sexes, the bony part of the same being articulated by a broad, rough, epiphysial basis to the cranium, and covered by a hairy tegument. The female brings forth one young one at a birth, and the period of gestation is fifteen months. The new-born giraffe measures six feet from the fore hoofs to the top of the head, and in a few hours after birth it is able to follow the dam. The flesh is eaten by the natives of Africa, and the marrow is considered a delicacy.

GIRASOL, *ge'-ra-sol* (Italian, sun-turning). A precious stone, resembling both quartz and opal. It reflects light, which seems to come from the interior of the stone. One variety found in Mexico, and known as the "fine opal," is very beautiful, the brightest stones of this kind are now brought from Brazil, and very fine specimens are obtained from Siberia.

GIRDLE OF VENUS, *Cestum Veneris*, a gelatinous ribbon-shaped animal found in the Mediterranean; about five feet long and two inches wide. The mouth is situated in the middle of the lower edge. It exhibits beautiful indescent colours by day and is luminous by night.

GLACIER, *glas'-e-er* (Lat., *glacies*, ice), an accumulation of ice, or of snow and ice, formed in a valley or ravine of a snowy mountain. The average annual fall of snow in the region of the Swiss Alps, from 8,000 to 10,000 feet above the level of the sea, has been estimated at sixty feet; that is to say, sufficient snow descends in one year to form a bed of this thickness. The accumulation of snow on the high table-land is called the *névé*, and is found to consist of layers of more or less crystalline snow, which diminish in thickness as their depth increases. The *névé* is the source of the glaciers, or rivers of ice, which fill all the valleys radiating from the central mass of a great mountain. Sometimes valleys twenty miles long and three or four broad are filled up with ice to the depth of some 600 feet. Although apparently solid and stationary, glaciers move slowly down their valleys, and carry with them, either on the surface, frozen into their mass, or grinding and rubbing along the bottom, all the fragments, large and small, from blocks many tons in weight down to the finest sand and mud, that rain, and ice, and the friction of the moving glacier itself, detach from the adjacent rocks. The glaciers of the Alps, and probably those of other regions, descend to a vertical depth of nearly 4,000 feet below the line of perpetual snow, and into a warm climate, before they finally melt away and leap forth as rivers of running water. The heap of materials of all sorts and sizes, which they deposit at their melting extremity, is called the *moraine*, a term which is also applied to the lines of blocks that are being carried along on the surface of the glacier. Combined with the *avalanche* and the *iceberg* (*see* these words), the glacier is now, as it has been in ages past, one of the most important of geological agents. (*See* GEOLOGY.) In continental Europe glaciers are almost limited to the Alps and Norway, but in Iceland, Spitzbergen, and Greenland they are of great size; and there are many among the lofty Himalayas of central Asia.

GLADIOLUS, *glad-e-o'-lus* (Lat., *gladius*, a sword, in allusion to the shape of the leaves), a genus of the natural order *Iridaceæ*, consisting of plants with ensiform leaves and very showy flowers, purple, red, or white. Many species and varieties, especially *G. communis* and *G. cardenales*, are in cultivation as border flowers.

GLANCE (Ger., *glanz*, brightness).—A popular name for many metallic minerals in which the metal is combined with sulphur, selenic, arsenic, or tellerium.

GLAND, *gland* (Lat., *glans*), an organ of the body, composed of blood-vessels, nerves, and absorbents, in which secretion is carried on; as the lachrymal, mammary, and salivary glands. According to their contents, they are divided into mucous, sebaceous, lymphatic, salival, and lachrymal. There are also what are termed ductless glands, which resemble the others in external conformation, but differ from them in the absence of any duct or opening for the removal of the secreted fluid, and, indeed, few of them contain any secreted fluid.

Glandular Swellings are not unfrequent, especially in weak and scrofulous persons. They occur about the neck, or other parts of the body, are comparatively painless, and of very slow growth, with little or no tendency to suppuration. In such cases, the system should be strengthened with tonics, and stimulants applied to the part: sea-bathing is also very beneficial. Glandular swellings also occur in certain diseases: as scarlet fever, &c.

GLANDERS, *gland'-ers* (from *gland*), a disease in horses, which is attended with a copious discharge of mucus from the nose, and which generally proves fatal to the animal affected. Scrofulous horses, on account of their weak constitution, are generally subject to glanders. Glanders is often communicated to the human system from horses affected with the disease, and generally ends in death to any one who has taken the infection. The best plan, therefore, with regard to horses infected is to shoot them at once, as they seldom recover, and, if they do, are certain to spread the disease amongst other animals.

GLASS CRABS.—A family of Crustaceans, taking their popular name from the extraordinary transparency of their bodies. The scientific name *Phyllosomata*, means "leaf-body," and refers to the great horizontal expansion of the upper shell. They are found in tropical seas; but are so transparent that, when floating on the surface of the water, they would be unperceived were it not for the bright blue colour of their eyes.

GLASS WORT.—A genus of plants (*Salicornia*) of the natural order *Chenopodiaceæ*. One species (*S. herbaca*), a leafless plant, with jointed stems, is found in salt marshes in this country, and is sometimes used as a pickle. On the shores of the Mediterranean, plants of this genus are employed in the manufacture of barilla, as they contain a large amount of soda. (*See* BARILLA.)

GLAUBER'S SALT, *glow'-ber* (after Glauber, a German chemist), the old name for neutral sulphate of soda. (*See* SODA, SULPHATE OF.)

GLAUCOMA, *glau-ko'-ma* (Greek, *glaukos*, sea green).—An opacity of the vitreous humour of the eye, imparting a bluish tint. It is very rarely curable.

GLAUCUS, *glau'-kus.*—A genus of slender gelatinous mollusca without distinct respiratory organs; included in the class *Gasteropoda*. They are less than two inches long, and of a delicate blue colour. They are met with in the Atlantic, within the tropics.

GLAUX, *glawks.*—A genus of plants of which the Sea Milkwort and Black Saltwort are well-known specimens. They belong to the natural order *Primulaceæ*.

GLOBE-FLOWER.—A genus of plants (*Trollius*) of the natural order *Ranunculaceæ*. Several species are known, natives of the colder parts of the northern hemisphere. The only species found in Britain is the Lucken Gowan (of Scotland) *T. Europæus*. It is an ornamental flower, chiefly growing in moist situations.

GLOBULARIA, *glo-bu-lai'-re-a*, a genus of *Selaginaceæ*. The species are European shrubs and herbs. The leaves of *G. Alypum* form the *wild senna* of Germany, which have been sometimes employed to adulterate senna leaves. They are tonic and purgative.

GLOBULE, *glob'-ule* (Lat., *globulus*, a little globe), a small particle of matter of a spherical form. The term is applied to the microscopic particles which float about in the transparent serum of blood; and is also applied to the form in which some Homœopathic medicines are sold.

GLOBULIN, *glob'-u-lin* (Lat., *globulus*), a term applied to one of the protein bodies, or albuminates, when associated with hæmatin. Although closely resembling albumen in many of its relations, it differs from that substance in being precipitated from acid and alkaline solutions when perfectly neutralised. It is also, when in solution, completely precipitated by carbonic acid gas.

GLOMERULE. (*See* INFLORESCENCE.)

GLORIOSA, *glo-ri-o'-sa.*—A genus of plants of the natural order *Liliaceæ*. *G. superb*, a native of India, has very beautiful red and yellow flowers.

GLOSSA OR GLOTTA, *glos'-sa, glot'-ta* (Gr.), is a name given to the tongue, and forms part of the name of various parts connected with that organ. The glosso-pharyngeal nerves are the ninth pair of nerves, rising from the processes of the cerebellum, and terminating by numerous branches in the muscles of the tongue and larynx.

GLOSSITIS, *glos-si'-tis.*—A term applied to inflammation of the tongue. It may result from various causes, as mechanical injury, exposure to cold, the use of mercury, &c. One of the chief dangers of the attack is suffocation. In mild cases, the application of leeches to the part, with the use of purgatives, will afford relief; but in the more severe forms the knife is to be freely used, and pretty deep incisions to be made into the inflamed part, which will afford almost instantaneous relief.

GLOTTIS, *glot'-tis* (Gr.).—The superior opening of the larynx, situated immediately behind the root of the tongue, and covered by the epiglottis. (*See* LARYNX.)

GLOW-WORM, *glo'-wurm* (Ang.-Sax.) (*Lampyris noctiluca*).—This well-known insect is rather more than half-an-inch in length, and of a blackish colour. The thorax is margined with dusky red, the legs and the segments of the body being of the same colour. The female resembles the male, but is quite destitute of wings. It is to the female that the name of glow-worm applies. The light proceeds from the under part of the abdomen, and near the tip; and it appears that the insect has the power to increase or subdue the intensity of the light at will. If the luminous part of the body be removed, it will continue for a considerable time to shine; and when the light is apparently extinguished, can be again kindled by softening the matter in water. If immersed in warm water, the insect still preserves its luminosity, but if placed in cold water the power is suspended.

GLUCINIUM, *glu-sin'-e-um*, a metal of comparatively rare occurrence in nature, where it is found in combination with silicic acid and alumina in the emerald, beryl, and euclase. It is prepared in the same way as aluminium, by decomposing the chloride with potassium or sodium. It is very similar in its properties to aluminium. Its salts have a peculiar sweet taste; hence its name, from *glukus*, sweet.

GLUCOSE, *glu'-koze* (Gr., *glukus*, sweet).—*Starch*, or *grape sugar*. A sugar formed from starch, either in the natural organism, or by allowing a mixture of starch and water to flow into a vessel containing a solution of sulphuric acid of one per cent. strength, at a temperature of 130°. Glucose crystallizes in warty concretions, composed of hard transparent cubes. With common salt it forms a compound that crystallizes with facility. It also forms definite compounds with the alkaline bases, giving rise to a powerful uncrystallizable acid, called *glucic acid*. (*See* also SUGARS.)

GLUMACEÆ, OR GLUMIFERÆ, *glu-mai'-se-e* (from Lat., *gluma*).—A sub-class of the *Monocotyledones*. It includes the Sedges and the Grasses. (*See* CYPERACEÆ and GRAMINACEÆ.)

GLUMES, *glumes* (Lat., *gluma*), the outer bracts of the locusta or spikelet of a grass.

GLUTEN, *glu'-ten* (Lat.), a characteristic ingredient in cereal seeds. If the flour of wheat or rye be made into a paste with water, and washed in a bag of fine linen, the starch is carried down by the water along with the sugar and dextrin: the remaining grey, sticky, and mucous mass is gluten. It cannot be regarded as a definite body, for, by means of hot alcohol, it may be separated into at least three distinct substances—one soluble in cold alcohol, which may be precipitated by water in a form resembling albumen, and termed glutin; another deposited by the alcohol as it cools, which has the composition and properties of casein; and a third, which remains undissolved, which may be regarded as vegetable fibrin. Gluten may be assumed to be the principal flesh-forming substance contained in wheat.

GLUTTON, *glut'-ton.*—A genus of quadrupeds (*Gulo*), natives of the arctic regions, and generally classed with the Bear family, which it appears to connect with the weasels. It is, including the tail, about three feet long, of a brown or black colour, and emits a strong musky odour. Its chief food is the smaller quadrupeds. In North America it is known as the Wolverine.

GLYCERINE, *glis'-er-een* (Gr., *glukus*, sweet), the sweet principle of oils and fats, which is separated from them during the process of saponification; in other words, it is the substance to which stearic, palmitic, oleic, and the other fatty acids, are united in stearin, olein, palmitin, &c. It is a viscid, colourless liquid, of a sweet taste, soluble in water and alcohol in all proportions, but sparingly so in ether. It dissolves most of the deliquescent salts, and many other substances which are soluble in water. It is slightly volatile at 212°; but if distilled alone, decomposes. It may, however, be distilled unaltered in a current of superheated steam. From its possessing the property of never drying up at ordinary temperatures, it has received many applications in the arts and manufactures. In Medicine, it is also used in preference to oil or other fatty matters, to keep sores in a soft condition, on account of the ease with which it may be washed off.

GLYCOSMIS, *gli-kos'-mis.*—A genus of plants natives of the East Indies and the Mascarene Isles, belonging to the natural order *Aurantiaceæ*. An East Indian species, *G. citrifolia*, bears a delicious fruit.

GLYCYRRHIZA, *glis-e-ri'-za* (Gr., *glukus*, sweet; *riza*, root). (*See* LIQUORICE.)

GNAT, *nat* (Sax., *gnæt;* Lat., *culex*), the common type of a family of dipterous insects of the section *Nemocera*. The proboscis is long and slender, projecting forwards, and terminated by two little lip-like appendages; sucker composed of six slender bristle-like members. The common gnat (*Culex pipiens*), is less than a quarter of an inch in length. Another species is the too well-known mosquito of tropical climates. The pain and irritation which ensues from its sting are caused by the proboscis piercing the skin and a poisonous fluid being injected at the same time. The humming noise which accompanies its flight is caused by the vibration of its wings, which move very rapidly.

GNEISS, *nise*, in Geology, originally a German term for a peculiar granitic-looking rock, occurring at the very base of the so-called "primary strata;" but now applied not only to the one rock, but to the whole suite of hard crystalline granitoid schists which constitute the lowest portion of the metamorphic strata.

GNETACEÆ, *ne-tai'-se-e*, in Botany, the Jointed Fir family, a natural order of *Dicotyledones*, sub-class *Gymnospermia*.

GNU, *nu*, an equine antelope, belonging to the section denominated *Connochetes*. It has a broad, spreading muzzle; horns bent downwards and outwards, broad at the base, and tapering to a point; the tail long and bushy, like that of a horse; the frontal bone much depressed, and the intermaxillary bones elongated. The gnu, or kokoon, as it is variously termed, inhabits the plains and wilds of South Africa, where it roams about in extensive herds. The neck, body, and tail, as well as the pace of the gnu, are nearly identical with that of a donkey or small horse, while its horns, and the long hair which surrounds its face and muzzle, give it the most uncouth appearance imaginable. The gnus are extremely wild and difficult for the hunter to approach, and from their firmness and courage a good deal of danger is attendant in shooting them. In height they are generally about three feet and a half at the shoulder, and their colour is a dark brown. The horns are common to the female as well as the male. When taken young, the gnu is very easily domesticated, and is often adapted to the plough in South Africa.

GOAT, *gote* (Sax., *gœt*).—A genus of ruminant quadrupeds (*Capra*), of the family *Capridæ*. The domestic goat varies more in size, stature, length and fineness of the hair, than any other animal, with the solitary exception of the dog. Its distinguishing characteristics are:—The horns are hollow, turned upwards, backwards, and outwards, annulated on their surfaces, and knotted in front. There are eight cutting teeth in the lower jaw and none in the upper; and the male is generally supplied with a beard or tuft of hair under the lower jaw. The domestic goat is one of the most useful of animals to man, and it bears every temperature, from that of the tropics to as far north as the northern part of Norway, where it remains exposed to all the inclemencies of the weather all day, being only sheltered at night in hovels which are nearly as much exposed as the open fields. In Norway, it feeds on moss and the bark of the fir-tree. The milk of the goat is far richer than that of a cow, and more digestible, and is suitable for invalids and children; and the hair is particularly useful in manufacture. The skin, especially that of the kid, is used for the making of gloves, and the flesh is often eaten, although it is rather coarse—that of the kid is esteemed quite a delicacy. The condition of the goat in the British islands is much more wild than that of any other of our domestic animals. From its being a courageous and powerful animal, its temper and motions are particularly inconstant, and it roams over the mountains of Wales as if it had never been domesticated, although, at the sight of the herdsman, it will be far more quick and playful and show more affection than the sheep, to which it is undoubtedly superior in many instances. The Cashmere goat is smaller than the domestic goat, and is likewise valued for the fineness of its fleece. This variety is a branch of the Thibet goats, which pasture on the Himalaya Mountains, in Hindostan. Many attempts have been made to cross the breed of the goat with the sheep, and some very successful results have followed. The Cashmere goat having been bred in with the Merino, a mule has been the result, which partakes of the good qualities of both. The Rocky Mountain goat of North America (*Antilope lanigera*) is another variety, and ranks next to the Cashmere goat for the excellence of the fleece. (*See* also ANGORA GOAT.)

GOAT-MOTH (*Cossus ligniperda*) belongs to the section *Lepidoptera nocturna* moths, and the family *Hepialidæ*. It is the largest of European moths, the expansion of its fore wings sometimes exceeding three inches. The colour of the hind wings is brown, with darker variations or mottles throughout the surface; while the fore wings are a dusky white clouded with brown, and varied with black irregular streaks, forming a species of network. The larva is about three inches in length when full grown, and takes three years to arrive at maturity, during which time it incloses itself in a tough cocoon, formed of pieces of wood gummed together with a glutinous sort of gum. The larva or caterpillar lives on the wood of the poplar, oak, and aspen, which it perforates in large holes; whence its name of *Ligniperda*.

GOAT-SUCKER, OR NIGHT-JAR (*Caprimulgus Europæus*), is a bird which derives its name from an absurd supposition, that it was in the habit of sucking the teats of goats and other animals at night. These birds are closely allied to the swallows and swifts, from which, however, they may be readily distinguished by the largeness of their eye and the softness of their plumage. The bill is short and depressed, and is very broad, with an enormously wide gape, which extends beneath the eyes, and is bounded by long bristles; the tarsi are short, and the toes long and strong: the wings are long and pointed. The goatsuckers are found in all parts of the world, and their habits are nearly identical. They fly about at dusk, in pursuit of moths and beetles; and from the rapidity and elegance of their flight, they are frequently mistaken for swallows. Their plumage is beautifully variegated by being freckled and barred with black, brown, and grey feathers diversely arranged. There are numerous varieties of this bird; as the banded goat-sucker and the crested goat-sucker; but they are all much alike. (*See* WHIP-POOR-WILL.)

GOBY, *go'-be.*—A genus of acanthepterous fishes (*Gobius*), the type of the family *Gobiedæ*. They are generally small fishes, found in shallow water, and are numerous in both the northern and southern seas. They construct nests of sea-weed and grass-wrack. There are several British species, the largest of them, about six inches long, being the Black Goby.

GODWIT.—A genus of birds (*Limosa*) of the family *Scolopacidæ*, frequenting marshes and shallow waters, chiefly on the sea-coast. They have long slender legs, and very long bills; and feed on the smaller crustaceæ and other small animals. There are two British species, the black-tailed and the bar-tailed. The length of the bird is about 16 inches, including the bill. The flesh is considered to be a delicacy.

GOITRE, *goy'-tr* (Fr., *goître*, probably a corruption of Lat., *guttur*, the throat), is a preternatural enlargement of the thyroid gland, occasioning a swelling of the throat, which frequently attains a very large size. It is also termed *Bronchocele* (Gr., *bronchos*, the throat, and *kele*, a swelling), and *Derbyshire neck*, on account of its prevalence in the hilly parts of Derbyshire. It is, however, in the Alpine districts of Europe, especially Switzerland, Savoy, and Tyrol, that it is chiefly to be met with. It is also common in certain regions of the Andes and Himalayas. It is frequently associated with cretinism (which *see*). Little is yet known of the nature or cause of this disease. It is endemic, or common to certain regions; but from what peculiarity of these regions it is owing is very uncertain, though many are inclined to attribute it to a calcareous impregnation of the water. It also occurs hereditarily, independent of endemic influence. The great remedy of this disease is iodine, either administered internally in small doses for a long time, or applied externally, either in the form of an ointment, or of the tincture painted over it every night. Generally, if not of long standing, the swelling will in this way be removed.

GOLD, *gold* (Sax., *gold*).—The metal which has in all ages been regarded as the most precious. In its ordinary metallic form it has a reddish-yellow colour. When pure it is nearly as soft as lead, and is the most malleable and ductile of all metals, but is inferior to many in its tenacity. It does not combine directly with any of the non-metallic elements, except chlorine, bromine, fluorine, and phosphorus. The oxygen acids do not combine with either of its oxides, and the only way in which the chloride can be formed is by dissolving it in hydrochloric acid, to which some oxydizing substance has been added, such as nitric acid, chromic acid, or binoxide of manganese. Selenic acid acts upon it by oxidation, its acid being converted into selenious. The hydrated alkalies do not act upon gold, except in a strong current of air, when auric acid is formed, which combines with the alkali. The higher alkaline sulphides dissolve it in the form of tersulphide. This important metal occurs in considerable quantity in different parts of the world, more especially in Mexico, Peru, Brazil, the Ural Mountains, California, Australia, New Zealand, British Columbia and Vancouver Island. It also occurs somewhat sparingly in the rivers of Hungary, Wicklow, and Wales.

GOLD OF PLEASURE.—A genus of plants (*Camellina*), of the natural order *Cruciferæ*, having small light yellow flowers. The common species (*C. sativa*) averages about two feet in height, and in some parts of Europe is extensively cultivated on account of the large amount of oil found in its seed. In medicine, the seeds are employed to make emollient poultices.

GOLDEN-CRESTED WREN.—A small and beautiful bird (*Regulus aurocapillus*), of the family *Sylviadæ*. It is not really a wren, though popularly described as one. The colour on the upper parts is greenish yellow, and the crown feathers form a light yellow crest. In some species the crest is red.

GOLDEN-EYE FLY.—A neuropterous insect (*Hemerobius perla*). Its length, including the antennæ, is about an inch and a half. It has large gauze-like wings and brilliant golden eyes.

GOLDEN ROD.—A genus of plants (*Solidago*), of the natural order *Compositæ*, closely allied to the aster. The common British variety averages about a yard in height, and bears yellow flowers. It is an ornamental plant. At one time it had a great reputation as a cure for wounds.

GOLDFINCH, *gold'-fintsh* (Sax., *gold-finc*) (*Carduelis elegans*), a species of birds included in the general class of *Fringillidæ*, and the gayest in appearance of all our native British birds. Its length from the tail to the tip of the bill is about five inches. The bill is white, tipped with black; the forehead and throat scarlet, the head black, the back brown, and rump a pale brown, the belly white, and a beautiful yellow stripe runs across the wings which are principally black with white edges. As its song is very sweet, the goldfinch is a universal favourite. It feeds on the seeds of various plants, particularly that of the thistle. It is found throughout Europe, but principally in this country. Being of very lively habits, the goldfinch can be easily trained both to imitate other birds, and thus be of use as a decoy, and to perform all manner of tricks. One species, with darker plumage and shorter bill, is the Aberdevine, or Siskin.

GOLD-FISH (*Cyprinus auratus*).—The gold and silver fish, as the gold carp is termed, has been long known in England; it was introduced into this country in the year 1691, from China, of which land it is a native. It belongs to the general class *Cyprinidæ*, and the section *Malacopterygii abdominales*, and is called the gold-fish from the splendid brilliant colour of the membrane which lies immediately beneath the scales. The colours of this fish are very various, some being all gold-colour, whilst others are of a fine bluish-brown or silver hue. When young it is very dark, nearly of a black colour. Sometimes the fins are doubled in the gold-fish, and they often have triple tails. It is not eaten, but valued from the beauty of its appearance. The best kinds of food are insects, bread crumbs, and dried yolks of eggs.

GOLIATH BEETLE, *go-li'-ath.*—A class of coleopterous insects which belong to the *Pentamera*. This family contains several sub-genera; but that which is generally known as the Goliath beetle is the *Goliathus cacicus*, which is a native of Africa and South America. This insect is remarkable for its large size; and, on account of its beauty and the difficulty of obtaining specimens, it is much prized amongst collectors. Not much is known as to the habits of this insect.

GOLOMYNKA, *gol-o-min'-ka.*—A fish found only in Lake Baikal, belonging to the Goby family. It is about a foot long.

GOMATO, OR GOMMUTI PALM, *go-ma'-to*, or *Argen*, a saccharifera.—A species of palm, found in the Moluccas and Philippines, which supplies abundance of sugar. Palm sugar is generally obtained from the juice which flows out from different palms upon wounding their spathes and adjacent parts. It is commonly known in India by the name of jaggery. The juice of the gommuti palm, when fermented, produces an intoxicating liquid or toddy. In Sumatra it is termed *neva*, and a kind of arrack is distilled from it in Batavia. From the trunk of this palm, when exhausted of its saccharine juice, a good deal of our commercial sago is obtained. A single tree will yield from 150 to 200 lbs. of sago. The juice of the fruit is very acrid. The stiff strong fibre known under the name of Gommuti, or Ejow fibre, is obtained from the leaf-stalks, and is extensively used in the manufacture of cables and various kinds of ropes.

GONIATITES, *gon-i-a-ti'-tes.*—A genus of fossil cephalopodous mollusca, in some respects resembling the ammonites. They are found only in the Palæozoic strata.

GONORRHŒA, *gon-or-he'-a* (Gr., *gonos*, seed, and *rheo*, I flow).—A painful discharge from the generative organs of the male, the result of sexual impurity.

GOODENIACEÆ, *good-en-e-ai'-se-e* (in honour of Dr. Goodenough, bishop of Carlisle), the *Goodenia* family, a natural order of *Dicotyledones*, sub-class *Corolliflorœ*, consisting of unimportant herbs, or rarely shrubs. They are principally natives of Australia and the islands of the Southern Ocean. The species *Scævola Taccada* has a soft and spongy pith, which is employed by the Malays to make artificial flowers and ornaments.

GOOSANDER. (*See* MERGANSER.)

GOOSE, *goose* (Sax., *gos*; Lat., *anser*), belongs to the order *Natatores*, *Anseres*, or *Palmipedes*, of the general family of *Anatidæ*. The general recognised type of the whole class is the *Anser niveus*, or snow-goose of Pennant and Wilson. This bird feeds principally on rushes and insects, and in the autumn on berries. It is found generally in the barren regions of North America, where it breeds in the most prolific manner. The *grey-lag*, or common wild goose, is the origin of the domestic goose. The bill is large, and of a flesh-colour tinged with yellow; the back grey; the breast and belly whitish, tinged with grey or ash-colour; and the wings and tail generally pure white, or at most merely tinged with the grey tint which prevails, more or less, over the whole body. It principally inhabits the sea-shores and marshes of oriental countries, and it rarely advances northward above the latitude of 53°. The tame goose is one of the most useful of birds to man, whether it is considered with respect to its flesh or its feathers. The bean-goose (*Anser segetum*) is a regular winter visitant to England, which country it generally arrives in in October, seldom leaving before April or May. The Canadian goose (*Canadensis*) is one of the great sources of food in the fur-countries of North America. When it arrives from more southern latitudes it is shot and otherwise killed in large numbers, with sticks and stones, and is carefully preserved in ice with the feathers on for the winter, during which rigorous season it is one of the principal articles of diet to the inhabitants of the fur-countries. The plumage of this bird is generally grey, and in its contour it approaches more closely to the swan (*Cygnus*) than any of the other branches of the family *Anatidæ*. The Brent goose, or *Torquatus*, is another variety of this tribe, and it is one of the smallest, as well as the most numerous in the British islands. It is a regular winter visitor to the shores of our maritime counties, says Yarrell, and it remains with us through all the cold months of the year, its predilection being more for the south and east coast. The livers of geese are esteemed as great a dainty in the present day as they were amongst the ancient Romans; a dish termed *pâte de fois gras* being made of them, which is a great favourite with epicures, and consequently high in price. The fat livers are only obtained at the expense of great cruelty to the birds.

GOOSEBERRY, *goos'-ber-re.*—A fruit-bearing shrub, a sub-genus of the genus *Ribes*. (*See* RIBES.) The common gooseberry (*R. Grossularia*) grows wild in many parts of Europe and Asia. In this country it is cultivated with great success and a large number of varieties have been produced. The pleasant and refreshing flavour of the fruit makes it a great favourite, and tarts, preserves, jellies, and wine are made from it. There are several American varieties.

Gooseberry Caterpillar.—A name given to the larva of a moth (*Abraxus grossulariata*). It feeds on the leaves of the gooseberry and currant.

GORAL, *go'-ral.*—A Nepaulese antelope, a wild and fleet animal of a greyish-brown colour, with short inclined horns. It is hunted on account of its flesh, which is much liked.

GORAMY, *go'-ra-me.*—A fish (*osphromenus olfax*), of the family *Anabasidæ*, found in the Chinese Seas and the Eastern Archipelago. It is a nest-building fish. The Dutch residents in Java keep goramies in large jars. Its form is deep in proportion to its length, the head is small, and the first ray of the ventral fin extends into a long filament.

GORDIUS, *gor'-de-us.*—A genus of *Annelida*, elongated and thread-like, which winds itself in a complicated manner, which is the origin of the name. In the country it is commonly known as the Hair-eel, it being commonly believed that this thin hair-like creature will develop into an eel.

GORDONIA, *gor-done'-e-a.*—A genus of trees and shrubs of the natural order *Ternstrœmiaceæ*. The most important is the Loblolly Bay (*G. Sasianthus*), growing near the sea-coast of the Gulf of Mexico. It attains a height of from 50 to 60 feet. The flowers are white and sweet-scented, and the bark is much used for tanning.

GORGONIA, *gor-gone'-e-a.*—A genus of zoophytes (*Anthozoa*), allied to *Alcynium* (which *see*).

GORILLA, *gor-il'-la* (*Troglodytes Gorilla*), a species of large ape which inhabits Western Africa. For a great number of years there was a vague tradition, unsubstantiated by reliable evidence, that apes of great size were to be seen on the west coast of Africa. It was not, however, till 1847 that the gorilla absolutely became known to naturalists. The points of difference between the gorilla and the chimpanzee are as follows: the gorilla is much longer than the latter animal; the ordinary height of a full-grown male is between 5 feet 6 inches and 5 feet 8 inches, and it is probable that many of the largest size exceed six feet in height. Its strength is tremendous, and its skeleton indicates great power in the jaws and limbs. The bony ridges above the eyes are very prominent, and the skull of the male exhibits a large occipital ridge on the top of the head. The brain is small, and the nasal bones project more than in the chimpanzee; these peculiarities give to the animal a hideous resemblance to the human face. The jaws and lower parts of the face project very much, and the teeth do not form an interrupted series, as in man. The canine teeth are very large, and the molars bear a greater proportion to the incisors; thus again approaching the features of a human being. It is very broad across the shoulders, has thirteen pairs of ribs, and approaches nearer to the human form in the shape of the pelvis than any other ape. The legs, although shorter in proportion than those of a man, are longer than those of the chimpanzee. When standing erect, the arms nearly reach the knees. The feet are formed for walking on the ground, and the great toe is a true thumb. The hands are remarkable for their great size and strength, the fingers being short but very thick. The skin of the gorilla is black in colour and covered with dark grey hair, which changes to a tawny brown on the head. The hair is longest on the arms. The face is hairy, but the chest is bare. The mouth is large and wide, and there is scarcely any appearance of neck. The eyes are much sunk, and in general the countenance is marked by a ferocious scowl. It is a voracious feeder, its food being exclusively vegetable; and its belly is very large and prominent. Gorillas are not gregarious in their habits; they generally live on the ground, but spend much of their time in climbing trees in search of food. Their immense strength enables them to defend themselves against beasts of prey. They live in the densest parts of the tropical forests, and are much dreaded by the inhabitants. As yet the gorilla has not been tamed, and it would appear as if it were incapable of being so in an adult state.

GORY DEW, *go'-re dew*, is a term frequently applied to the dusky red film seen upon the damp walls of cellars, or other moist situations. Its disagreeable and alarming nature is due to the unpleasant fact of its resembling the stains of blood

GOSHAWK, *gos'-hawk* (Sax., *goshafoc*, goose-hawk), a bird which belongs to the general family of the *Falconidæ* (*Astur palumbarius*), of which it is more or less a type. The great distinguishing points between the goshawk and the falcons, are the lobe, or festoon, instead of the sharp tooth on the cutting edge of the upper mandible, and the short and rounded form of the wings. Although inferior in powers to the falcon, the goshawk is the best of the short-winged hawks; but its habits and mode of flying its game are very different—as it does not *swoop*, but glides along at a short distance from the ground, in an even line with the bird it pursues. A full-grown female measures from 23 to 25 inches in length; and the males one-third, or sometimes one-fourth, less. When adult, the plumage is generally similar. The beak is horn-colour, or bluish-black; the cere and irides yellow; the top of the head, the whole of the back, upper surface of the wings and tail-feathers, of a dark greyish-brown colour: in the female this tint is more of a clove-brown. The upper surface of the tail-feathers is bound with even a darker brown colour; while a band of white, variegated with spots and bars of black, passes over the cere, the eyes, cheeks, and ear-coverts, the nape of the neck, throat, breast, belly, and thighs. The under tail-coverts are white, the cere, cheeks, and ear-coverts, greyish-brown, forming an elongated dark patch on the side of the head; while the legs and toes are yellow and the claws black. The goshawk is used principally for the pursuit of hares, rabbits, and partridges, on account of its low flight. It is not very eager in hunting its prey, as, if its speed is eclipsed, it sits patiently on a tree and waits for other game to present itself.

GOSSAMER, *gos'-sa-mer.*—A very light filament produced by various species of small spiders. They float in the air, and are so fine as to be almost imperceptible, except when a bright sunlight falls on them. The spiders which produce them are often carried up by them. Gossamer threads are frequently spread upon the ground.

GOSSYPIUM, *gos-sip'-e-um.* (*See* COTTON.)

GOURA, *goo'-ra.*—A very large bird (*Columba coronata*), of the Pigeon family, a native of the islands of the Indian Archipelago and New Guinea. It measures nearly two feet six inches between the extremities of the bill and tail; has a large semi-circular red crest, and the plumage is generally of a bluish colour, varied by black and purplish brown, and a white bar on the wings. It is highly valued for the table.

GOURD, *gourd* (Fr., *courge*), the common name for a large cucurbitaceous fruit. (*See* PEPO.) The plant named *Cucurbita Pepo* yields the white gourd, or pumpkin, of which the vegetable marrow is an improved variety; *C. maxima*, the largest of the family, frequently more than two feet in diameter; *Lagenaria vulgaris*, the bottle-gourd, often used as a receptacle for fluid; *Luffa fœtida*, the sponge-gourd; and *Trichosanthes anguinea*, the snake-gourd. The Squash (*C. melopepo*), one of the best gourds, and especially cultivated in North America, differs from other species in appearance, the plant forming a bush, and the gourd being of a flattened shape. The wild gourd of the Old Testament is supposed to have been the bitter cucumber, or colocynth.

GOUT, *gowt* (Fr., *goutte;* Lat., *gutta*, a drop), a painful disease of the joints, generally of the feet or hands, and more particularly of the great toes. It occurs mostly in persons advanced in life, and who indulge freely in the pleasures of the table; and is hereditary. The attack is usually preceded by a disordered state of the digestive system, and commonly begins by a painful swelling of the first joint of the great toe. It returns at longer or shorter intervals, when it may attack various other parts; but generally the great toe is the chief seat of the disease. Sometimes the attack comes on without any previous warning; but usually, for some days or weeks before, the patient has been suffering from indigestion, with diminished appetite, flatulence, costiveness, and a general feeling of lassitude and depression of spirits. He goes to bed, perhaps, in tolerable health, and after a few hours is awakened by the severity of the pain in the great toe, or sometimes in the ankle, heel, or calf of the leg. The pain resembles that of a dislocated bone, and is attended with the sensation as if cold water was poured over the part; and this is succeeded by chilliness, shivering, and other febrile symptoms. These gradually abate as the pain increases, and it continues usually to the following night, with sometimes, however, a period of intermission during the day. The pain is of a burning or gnawing character. The next night, after some time of tossing and restlessness, the patient succeeds in falling asleep; a gentle perspiration breaks out, and he awakes to find himself refreshed and the part comparatively free from pain. On examining the limb next morning, it is found to be considerably swollen, the toe red and shining, and the veins of the foot much distended. There are usually a number of subsequent attacks, becoming less and less severe, before what is known as "a fit of the gout" is over; so that it commonly extends over a period of several weeks, or even months. When the fit is over, the system is relieved, and the person feels, both in mind and body, much better than before the attack. The fits are more apt to occur in spring or autumn than at other seasons of the year; probably owing to the variableness of the weather at these times. There are other kinds which differ widely from ordinary gout in their general character. In atonic gout, the disease, instead of manifesting itself in the joints, attacks some of the internal organs, as the stomach, when the patient suffers from indigestion, nausea, vomiting, and severe pains; or the thoracic viscera, when palpitations, fainting, and asthma arise. Retrocedent gout (*Podagra retrograda*) is when, after the inflammation has occupied a joint, it suddenly disappears and is transferred to some internal part, as the stomach, heart, lungs, or brain, when it may give rise to various fatal disorders. Misplaced gout is when, instead of attacking joints, the disease proceeds inward, and causes an inflammatory affection of some of the internal parts, with the same symptoms that attend inflammation of these parts from other causes. The cause of gout is the excess of uric acid in the blood, resulting either from an excessive formation or a checked excretion. Topical remedies are of little use. Persons having a tendency to gout should give strict attention to diet and plenty of active exercise.

GOUT WEED.—A common weed (*Ægopodium podagraria*), perennial and ambelliferous, once in great repute as a cure for gout. It is also known as Bishopweed and Herb-gerard.

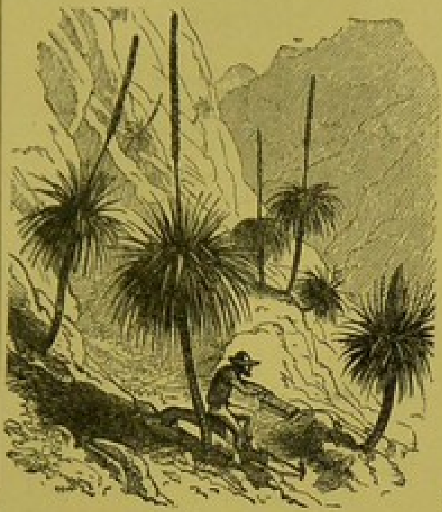
GRACILLARIA, OR PLOCARIA, *grasil-lai'-re-a*, a species of plants belonging to the natural order *Algæ*, or Sea-weeds. The *Gracillaria lichenoides* is our commercial Ceylon moss. It is nutritive, emollient, and demulcent, and may be employed in the form of a decoction or jelly as a food for children and invalids; and medicinally in pulmonary complaints, diarrhœa, &c. It is sometimes imported under the name of agar-agar, but *Gracillaria spinosa* has also been imported under the same name. Both species are largely used in the East for making nutritious jellies, for stiffening purposes, and for varnishing. *Gracillaria Helmintho-corton* is Corsican moss. It has been used principally as a vermifuge, but its properties have been much overrated. *Gracillaria crassa*, or Ki-tsai, is cooked with soy or vinegar in China; and is also used by the Chinese ladies for giving a gloss to their hair.

GRAINS OF PARADISE. (*See* AMOMUM.)

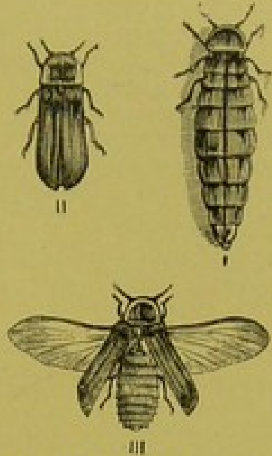
GRAKLE, *grai'-kl.*—A common name of many birds of the starling family (*Sturnidæ*). Most of them are natives of India and Africa, the Mina birds of India, which belong to this family, are remarkable for their power of imitating human speech; and the Paradise grakel (*Gracula gryllivora*), is well known as a destroyer of locusts and caterpillars.

GRALLÆ, GRALLATORES, *gral'-le gral-lai-to'-reez* (Lat., *grallæ*, stilts), the wading birds. The order comprises all those birds which live both on land and sea, and to which both elements are essential. Those which are essentially aquatic have a short web to their toes; their wings are long, and, having no settled district, they fly from one shore to another as the seasons change. Several fossil remains of the families of this order of birds have been found. The fossil footsteps of wading birds, observed in the new red sand-stone valley of the Connecticut, show that formerly at least seven species of Grallatores existed, varying in size from that of a snipe to twice that of an ostrich.

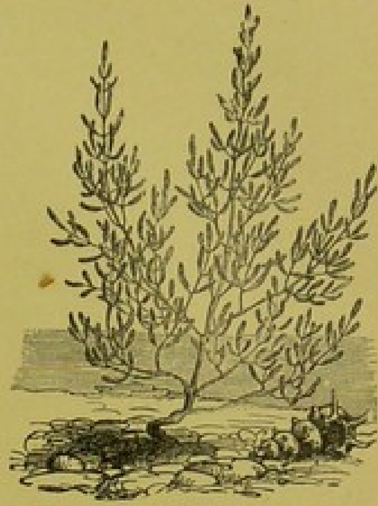
GRAMINACEÆ, *gram-in-ai'-se-e* (from *gramen*, grass).—The Grasses, a natural order of *Monocotyledones*, sub-class *Glumaceæ*. Of all the orders in the vegetable kingdom, this is the most important to man, as it affords his principal food, and is eminently serviceable in other respects, by supplying fodder for cattle, sugar, and numerous useful products. As a botanical group, there is none more natural, for the variations observed in the herbs, shrubs, and arborescent plants composing it, are of the simplest kind, arising generally from differences in the proportions of parts. Grasses are universally distributed over the globe. In temperate and cold climates they are herbaceous, and of moderate height, while in tropical climates they



GRASS TREE.

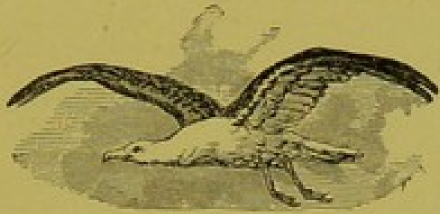


I. BRITISH GLOWWORM.
2. MALE. 3. MALE FLYING.



GLASSWORT.

GREENFINCH.



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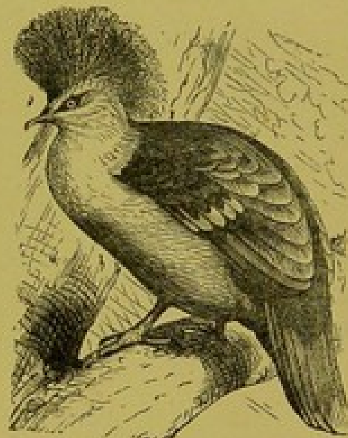

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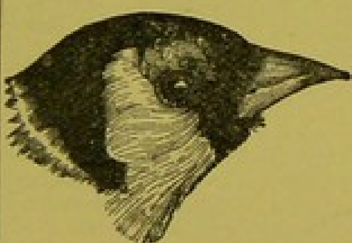

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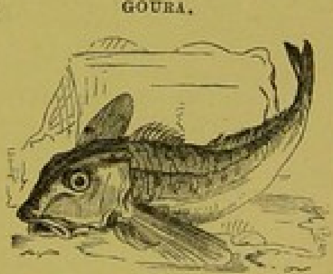


GURNET.

GAMBIR.

GORILLA.

GUTTA-PERCHA TREE.

become shrubby and arborescent, and sometimes grow to the height of fifty or sixty feet. Grasses usually grow together in large masses, and thus form the verdure of great tracts of soil: hence they have been termed social plants. There are 300 genera and probably about 3,800 species. The most important genera are *Triticum*, wheat; *Hordeum*, barley; *Avena*, oat; *Oryza*, rice; *Zea*, Indian Corn, or maize; *Secale*, rye; *Panicum*, millet; *Saccharum*, sugar-cane; *Bambusa*, bamboo; *Andropogon dactylis*, and *Holcus*.

GRAMPUS, *gram'-pus.*—A cetaceous animal, the largest of the *Delphinidæ*, or Dolphin, sometimes attaining 20 feet in length. It is common in the Arctic seas, and frequently appears on the British coasts. It is commonly classed with the porpoise. It is very strong and active, and will even attack whales. Grampuses are generally met with in small herds.

GRANADILLAS, *gran-a-dil'-las* (Sp.), the edible fruits of certain species of passion-flower. (*See* PASSIFLORA.)

GRANITE, *gran'-it* (Lat., *granum*, a grain), an igneous rock, so named from its granular structure. The typical granite is a crystalline aggregate of the three minerals, felspar, mica, and quartz. The proportions of the three constituents vary indefinitely, with this limitation, that the felspar is always an essential ingredient, and never forms less than a third, rarely less than half of the mass, and generally a still larger proportion. Sometimes the mica, sometimes the quartz, becomes so minute as to be barely perceptible. The state of aggregation of the mass varies also greatly, some granites being very close and fine-grained, others largely and coarsely crystalline. The colours of the rock are generally either red, grey, or white—the first when the felspar is coloured, the latter when it is pure white, the intermediate grey tints depending chiefly on the abundance and colour of the mica, but sometimes on that of the quartz. The hard and close-grained granite forms the most durable building-stone for heavy structures; the soft and decomposable yields the finest *kaolin*, or china-clay. The granites of Devonshire and Cornwall are exceedingly durable. The kerb and paving-stones are obtained almost exclusively from the county of Aberdeen. In the district of Peterhead the red granite principally prevails; hence it is commonly called "Peterhead granite." Argyleshire also affords excellent granite. The Isle of Man possesses a grey granite; and in Lundy Island, which is almost exclusively of a granitic formation, are quarries of a very rich and productive kind. In Ireland, the counties of Wicklow, Carlow, Kilkenny, and Galway are occupied by a considerable area of granite. Wicklow granite is extensively used; the variety obtained from the neighbourhood of Kingstown being of a hard and coarse character; whilst that quarried at Golden Hill, being of a finer kind, is more used for the purpose of ornamentation.

Granitic Rocks, those igneous rocks which partake of the character and appearance of granite. (*See* IGNEOUS ROCKS.) They are highly crystalline, and their component crystals are never rounded or water-worn; they present no traces of deposition or stratification; they occur in the earth's crust, as mountain-masses and veins, bursting through and displacing the sedimentary rocks; and they indurate, and otherwise alter (as all heated masses do), the strata with which they come in contact. (*See* GEOLOGY.)

GRANULATION, *gran-u-lai'-shun* (Lat., *granum*, a grain), the name given to that process by which small grain-like fleshy bodies form upon the surface of ulcers and suppurating wounds, and serve for filling up their cavities, and bringing nearer together and uniting their sides.

GRAPES. (*See* VITIS.)

GRAPHITE, *graf-ite* (Gr., *grapho*, I write), is black-lead, a mineral consisting of nearly pure carbon, found in many parts of the world. It occurs in prismatic masses with a transverse foliated structure, also granular and compact. The finest quality is found at Borrowdale, in Cumberland. It is nearly pure carbon, and is perfectly free from grit. It is used principally in the manufacture of lead-pencils. The coarser quality is used, when ground, for polishing iron-work, for glazing gunpowder, as a lubricator for machinery, and in the manufacture of black-lead melting-pots. (*See* BLACK-LEAD, PLUMBAGO.)

GRAPTOLITES, *grap'-to-lites.*—Fossil zoophytes, with polypidoms formed of a horny substance. Nearly eighty species are known, found in the Silurian strata.

GRASS OF PARNASSUS, *par-nas'-sus.*—A genus (*Parnassia*) of small herbaceous plants with flowers growing in moist situations in the colder parts of the northern hemisphere above the snow line of the Alps and Himalaya, and within the Artic circle. One species (*P. palustris*) found in marshy situations in Britain and various parts of the continent of Europe, has heart-shaped leaves and a stem about nine inches high, with one yellowish-white flower which appears in autumn.

GRASSES. (*See* GRAMINACEÆ.)

GRASSHOPPER, *grass-hop'-per.*—The name given to many species of insects common in the British islands and in foreign countries, belonging to the general family of the *Gryllidæ*, which latter come under the class of *Orthoptera*, and its sub-section *Saltatoria*, or jumpers. The grasshoppers, like other Gryllidæ, are characterized by their legs and antennæ being very long and slender, the wings large and delicate, and the wing-covers often extending far beyond the extremity of the abdomen. In the male insects these wing-covers are furnished at the base, near the suture, with a round tail-like plate, surrounded by strong ridge-like bands; and the chirping noise peculiar to the family is produced by rubbing the cases of the wing-covers sharply over each other, these ridges serving the purpose of a sort of drum. The common great green grasshopper of this country (*Gryllus viridissima*) is one of the largest of our native insects, and measures about two inches in length and three and a half in the expansion of its wings.

GRASS MOTH.—A genus of small moths, frequenting grass pastures. They are brown and white, or silvery and golden.

GRASS-OILS. (*See* ANDROPOGON.)

GRASS-TREES. (*See* XANTHORRHÆA.)

GRASS-WRACK, *rak.*—A genus of plants (*Zostera*), of the natural order *Naiades*, growing among seaweeds at the bottom of the sea. The common grass-wrack (*Z. marina*) grows abundantly in the shallow parts and creeks of almost all the European seas. It is used as a covering for flasks in Italy, and in northern Europe for stuffing pillows and mattresses.

GRATIOLA, *gra-she-o'-la* (Lat., *gratia*, grace—a species having been named *Gratia Dei*, grace of God, by Mathiolus).—The Hedge-hyssop, a genus of the natural order *Scrophulariaceæ*. The species *G. officinalis* possesses purgative, emetic, and diuretic properties, and was formerly employed in medicine. Its properties are due to the presence of an acrid poison.

GRAVEL, *grav'-el* (Fr., *gravelle*), the familiar as well as technical term for accumulations of water-worn rock-fragments, where the pebbles vary from the size of a pea to that of a hen's egg. Accumulations of finer detritus are known as *sand*, and those of fragments larger than an egg as *shingle*.

In Medicine. (*See* CALCULUS.)

GRAVITATION, *grav-i-tai'-shun* (Lat., *gravis*, heavy).—A term nearly synonymous with gravity, and applied to denote that tendency which all bodies in nature have more or less to approach each other. This force of gravitation varies directly as the masses of the bodies, and is inversely proportional to the squares of their distances apart from each other. The mutual attraction of all particles of matter is termed the *attraction of gravitation*, and the aggregate of all the particles of any one particular body, or mass of matter, is termed the *gravity* of that body. It is plain to all, from everyday experience, that a body abandoned to itself, and left unsupported, immediately falls towards the surface of the earth. The direction which a falling body takes is exactly perpendicular to the earth's surface, and, consequently, as the earth is a sphere, towards its centre. The direction, therefore, of terrestrial gravitation is towards the centre of the earth. If we suppose that the earth, without undergoing any alteration of its dimensions, were to become more compact by a hundredth part, or, in other words, that within the same volume it contained a hundredth part more matter; then the attractive force which it would excercise on bodies placed on its surface would be increased a hundredth part. All bodies must necessarily move towards, or in the direction of, the centre of the earth, by the effects of this gravitation, as a sphere always attracts an exterior body in a manner as if all its matter were condensed into a single point at its centre. From the axiom that all bodies, when deprived of support, fall from any height to which they may have been elevated, it may be justly inferred that gravity acts upon them during the whole time occupied in their descent with a uniformly accelerating force, which may be proved from the fact that bodies which fall from a greater height than others arrive at the earth with a proportionably greater velocity. (*See* FALLING BODIES.) One of the simplest illustrations of the force of gravity is that of throwing a stone in a straight or horizontal plane, when the stone's course will be evolved in a curve, and the stone at length will drop to the ground. The flights of shot and shells are likewise illustrative of the same rule. We are indebted to Sir Isaac Newton for the principles and applications of *universal gravitation*, and through it, by means of geometry, we are able to possess the correct information that we have with regard to the movements of the earth, sun, and moon, and other heavenly bodies. The first rule is that the attraction of one body upon another body does not depend upon the mass of the body which is attracted, but is the same whatever be the mass of the body so attracted, provided that the distances be the same. For instance, the planet Jupiter attracts the sun, and also attracts the earth; but although the sun's mass is 300,000 times that of the earth, yet the attraction of Jupiter on the earth is exactly equal to his attraction of the sun, because the earth and sun are equally distant from Jupiter.

GRAVITY, CENTRE OF. (*See* CENTRE OF GRAVITY.)

GRAVITY, SPECIFIC. (*See* SPECIFIC GRAVITIES.)

GRAYLING, *gray'-ling* (Ang.-Sax.), a fresh-water fish (*Thymallus vulgaris*), of the family of the *Salmonidæ*, and very like the trout in habits and appearance. Its body is long and flat, and seldom exceeds eighteen inches in length. The head is small, pointed, and flattened at the top. The back and sides are silvery-grey in colour (whence the name), but when the fish is fresh caught, this colour is seen to be variegated with blue, gold, green, and black spots. The grayling is very abundant in England, Sweden, Lapland, and Norway, and it partakes of the usual characteristics of the rest of the *Salmonidæ*, although it is in season generally when they are out. (*See* SALMONIDÆ.)

GREBE, *grebe* (Ang.-Sax.).—A bird (*Podiceps*) which belongs to the order *Natatores*, and its sub-section *Columbidæ*. Grebes belong to that division of the divers which more particularly frequent fresh water; and the great crested grebe, the largest of the genus, is resident all the year in parts of this country which afford reeds and other aquatic vegetation, as in the lakes of Wales, the meres of Shropshire and Cheshire, the broads of Norfolk, and the fens of Lincolnshire. They are seldom seen to fly or walk, being mostly in the water. The form of the whole bird being that of an elongated cone, is admirably adapted for diving, and their habits can only be observed by those who live in the vicinity of their favourite pools. Besides the Great Crested Grebe, there are the Red-necked Grebe, the Sclavonia, the Tippet, the Little, the Horned, the Eared, the Dusky, and the Black-chin grebe. The generic characters of all are very similar. The length of the grebe is generally between twenty-one and twenty-two inches, and from the carpal joint to the end of the longest feathers is eight inches.

GREEN EARTH.—A mineral, consisting principally of silica, alumina and protoxide of iron, found chiefly in trap rocks. Under the name of Mountain Green, it is used as a water-colour pigment.

GREEN EBONY.—A dyewood imported from South America; the wood of a tree known as the *Jacaranda ovalifolia*.

GREENFINCH, *green'-fintsh* (*Loxia chloris*), belonging to the *Coccothraustes*, of the class *Fringillidæ*. It is also called the green linnet and green grosbeak. The beak is conical, and very thick at the base, gradually tapering to a point, and of a white colour generally. The head and back of the bird are yellowish green, the breast and rump yellow; the tail slightly forked, black in the centre and yellow at the edges; the wings long, and green in colour. The greenfinch is very common in England, and it is easily tamed. It imitates the songs of other birds, but is not much prized as a native songster.

GREENGAGE.—A plum, the *Reine Claude* of the French. It is a green colour and roundal shape, and is unsurpassed for delicacy and richness of flavour.

GREENHEART.—A valuable timber tree (*Nectandria Rodiæa*), of the natural order *Lauraceæ*. It is a native of Guiana. The bark, known as Bebeerei, has valuable medicinal properties. (*See* NECTANDRIA.)

GREENLAND WHALE. (*See* WHALE.)

GREEN-SAND, the term applied to the lower portion of the cretaceous system (which *see*) as developed in the South of England, from the greenish colour of some of the beds of sand.

GREEN, SCHEELES'S.—An arsenite of copper.

GREENSHANK.—A bird (*Totanus glottis*) of the same genus as the sand-piper. It is about the size of a wood-cock, but has much longer legs. The plumage is dusky brown on the upper parts, and white beneath, and the feathers are edged with dusky white. It is a bird of passage, and ranges from the arctic to tropical regions.

GREEN SICKNESS. (*See* CHLOROSIS.)

GREENSTONE, a general name for the hard granular-crystalline varieties of *trap* (which *see*), consisting mainly of felspar and hornblende, felspar and augite, or felspar and hypersthene. The term has reference to the greenish, or blackish-green, colours which these igneous rocks commonly exhibit.

GREENSAND.—Two divisions of the cretaceous formation, known as the Upper and Lower Greensand. (*See* GEOLOGY.) The strata of the former sometimes attain a thickness of 100 feet, and of the latter of more than 800 feet. They both contain many fossils. The name originated in the frequent appearances of green specks of silicate of iron in the beds.

GREENSTONE. (*See* TRAP.)

GREENWEED.—A species of Genista. (*See* GENISTA.) Dyers' Genista (*G. tinctoria*), about two feet high, rich pale yellow flowers, is common in most parts of Europe and the temperate parts of Asia, the leaves and seeds were formerly used in medicine as a diuretic and mild purgative.

GREGARINIDÆ, *greg-a-rin'-i-de.*—Microscopic organisms, of the sub-kingdom *Protozoa*, parasites in the intestinal canal of some invertebrate animals, especially insects and some worms.

GREGARIOUS ANIMALS, *gre-gai'-re-us* (Lat., *gregarius*, from *grex*, a herd), is a term applied to those animals which have the habit of assembling or living in flocks or herds.

GREYHOUND, *gray'-hownd* (Ang.-Sax.) (*Canis graius*). A species of dog used for the chase, which appears to have been known even in the most remote ages of antiquity, as it is represented on some of the oldest of Egyptian monuments. It is probably of Asian origin. The cultivated English greyhound exhibits a model of elegance, and a combination of symmetrical proportions probably unrivalled by any other animal but the race-horse; and the perfection of the mechanism for speedy progression is apparent throughout its structure. As the greyhound hunts by sight rather than by smell, its eyes are placed more conspicuously forward than in other dogs. The head is beautifully shaped, and slender in proportion; its muzzle is long and pointed; the ears droop at the points; the back is broad and muscular; the body being lank, and very much contracted in its lower parts. The legs are long and muscular, while the chest is capacious and deep, with the tail slender and curved upwards at the end. The *Italian greyhound* is a much smaller variety than the English, and is a very delicate animal, more fit for the duties of a lapdog than for those of the chase.

GREYWACKÉ, *grai-wak'-a* (German, *Grauwacke*).—An argillaceous rock, chiefly found in the Silurian and Cambrian strata.

GRIAS, *gri'-as*, a genus of plants belonging to the natural order *Myrtaceæ*, natives of Jamaica. There is only one species, the *G. cauliflora*, or anchovy pear. In appearance it is a tall tree, with small branches, very long oblong leaves, and large white flowers, placed on short many-flowered peduncles. It generally grows in boggy places, and its fruit is an ovate, being as large as an alligator's egg, and of a brownish-russet colour. This fruit is pickled, and eaten in the same way as a mango.

GRIFFEN VULTURE.—A French name for the Tawny Vulture, found in the mountainous regions of Europe, Asia, and northern Africa. It is about four feet long, and mostly of a yellowish-brown colour.

GRIT, a coarse grained sandstone, with angular particles held together by hard silicious cement.

GROMWELL, *grom'-wel.*—A genus of plants (*Lithospermum*) of the natural order *Boragineæ*. The Common Gromwell (*L. officinale*), a native of dry gravelly places in Europe, Asia, and North America was formerly believed to be of great value as a curative for stone in the bladder. There are many branches on the stem, and the flowers are of a yellowish colour.

GROSBEAK, *grosè-beek* (*Coccothraustes*), a bird which comes under the general head of *Fringillidæ*, in the sections of *Insessores, Conirostres*. There are several varieties; as the hawfinch grosbeak (*Coccothraustes vulgaris*), the pine grosbeak (*Loxia enucleator*), and the green grosbeak, which is treated under the head of GREENFINCH (which *see*). The hawthorn grosbeak, or common grosbeak, inhabits England, France, some parts of Italy, Germany, Sweden, and even the South of Russia. The varieties in the colour of this bird are white, yellowish-grey, and grey; the wings and tails are often white, and the plumage generally partakes of that colour. The nest, which the female builds, is one of the prettiest kind, being coloured and decorated with all kinds of brilliantly-tinted mosses, and lined inside with down and feathers. The eggs are of a bluish-green colour, with brown spots. The bird is generally about seven inches long; it has no song worthy of notice, and is not a common bird with us, although it is to be met with in England. (*See* FRINGILLIDÆ.)

GROSSULARIACEÆ, *gros'-su-la-re-ai'-se-e* (Lat., *grosula*, a gooseberry), the Gooseberry or Currant family, a natural order of *Dicotyledones*, sub-class *Calyciflorœ*, consisting of shrubs, natives of the temperate regions of Europe, Asia, and North America. There are but two genera and 95 species. Some are showy garden plants; but they are mostly remarkable for their agreeable acid fruits, known as gooseberries, and red, white, and black currants. (*See* RIBES.)

GROUND IVY, *i'-ve.*—A common native plant of this country, known to botanists as *Glechóma hederacea.* It has a creeping stem with bunches of blue flowers. The plant is stimulant and aromatic, and in country places a decoction made from the leaves is supposed to possess valuable medicinal qualities. The leaves were used for flavouring ale before the introduction of hops.

GROUNDLING.—A small fish (*Botta tænia*) of the family *Cyprinidæ*, named from its habit of keeping close to the bottom of rivers. It resembles the loach, but is smaller, and has a faded space beneath each eye.

GROUND LIVERWORT. (*See* PELTIGERA.)

GROUND NUT. (*See* ARACHIS.)

GROUNDSEL.—A common name for various species of *Senecio*, which have small heads of flowers. The Common Groundsel is a well-known garden weed, which supplies a favourite food for cage birds. The leaves are used for poultices.

GROUND SQUIRREL.—A rodent quadruped (*Tamias*) of the squirrel family, but differing from the others in having cheek-pouches and shorter legs, and in living mostly on the ground. It is of small size, and marked by longitudinal shapes. The fur of an American species, *T. Lysteri*, is used for muffs.

GROUSE, *growse* (Ang.-Sax.), a species of game bird which belongs to the family of the *Tetraonidæ*. The bill is rather short, broad at the base, compressed and arched, with the tip obtuse, the nostrils being placed at the base of the bill, and protected with feathers, or a hard scaly substance; the legs are stout, with the *tarsi* naked and scutellate, but sometimes covered with feathers to the toes; the hind toe, which is rarely wanting, is rather small and elevated, the wings short and rounded, and the tail also rounded at the extremity. These birds live chiefly on the ground, on which they can run with great swiftness, and they feed principally on vegetable substances, such as berries, seeds, and the buds of trees and shrubs. They vary greatly in size, some being nearly as large as a turkey, while others scarcely exceed a pigeon in size. There are several varieties of the grouse. The most important bird of this class is called the capercailzie, or wood grouse. (*See* CAPERCAILZIE.) To speak correctly, however, the blackcock (*Tetrao tetrix*) is one of the largest species of grouse which can be termed truly British, as it is found both in England, Scotland, and Ireland. The common grouse or ptarmigan (*Lagopus vulgaris*), is another variety of this species. The red grouse (*Lagopus scoticus*) is peculiar to these islands, and inhabits all heathy districts, whether lowland or mountainous. The red grouse is the same colour in plumage all the year round, whilst the ptarmigan acquires a white habit in the winter months. The red grouse is a most prolific bird.

GROWLER.—A fish (*Grystes salmoides*) of the Perch family, a native of North America. It is about two feet long, of an olive colour. It is a favourite fish for the table.

GRUB, *grub* (Ang.-Sax.), a small worm: it is a name, however, more properly applied to the hexapod worms produced from the eggs of beetles, &c., which are eventually transformed into winged insects. (*See* PUPA.)

GRUGRU, *groo'-groo.*—The larva of an insect of the weevil family, inhabiting the tropical parts of South America. It is about three inches long, and makes its home in the centre of the cabbage palm. Although disgusting in appearance to Europeans, it is cooked and eaten as a delicacy.

GRYLLUS, *gril'-lus.*—A genus of insects of the order *Orthoptera*, and generally considered to include the cricket, grasshopper, and locust.

GRYS-BOC, *grees'-boc.*—A small antelope of South Africa, about three feet in length, and eighteen inches high. Its flesh is considered a delicacy.

GUACHARO, *gua'-ka-ro.*—A bird (*Steatornis Caripensis*), of the order *Insessores*, a native of South America. It is about the size of a common fowl; and although living on fruit is of nocturnal habits, hiding in the day in dark caverns. The fat of the bird is clarified and used for butter and oil.

GRYPHOSIS, *gri-fo'-sis* (Gr., *grupoein*, to incurvate), in Surgery, is a disease of the nails, which turn inwards, and irritate the soft parts below.

GUAIACUM, *gwai'-ya-kum* (from *guayac*, its native name), a genus of the natural order *Zygophyllaceæ*. The species *G. officinale* is a fine evergreen tree from 40 to 60 feet in height, and of a dark gloomy aspect. It is a native of the West-India islands, particularly Cuba, St. Domingo, and the south side of Jamaica. (*See* SIGNUM VITÆ.)

GUALTHERIA, *gwal-the'-re-a*, a genus of the natural order *Ericaceæ*. The species *G. procumbens* is a native of North America, and is commonly known as the partridge-berry. Its leaves possess aromatic, astringent, and stimulant properties, which they owe to the presence of a volatile oil and tannin. An infusion of the leaves is used as a substitute for China tea, and is called Mountain or Salvador tea.

GUANO, *gu-an'-o* (from the Peruvian word *huano*, dung), the excrement of sea-fowls, found principally in large quantities upon some parts of the coasts of Peru, Bolivia, and Africa. Although of comparatively recent use in this country, guano has been employed as manure by the inhabitants of Peru from the most remote periods. There seem to be three varieties of guano in Peru; the white, grey, and red. The red is the oldest deposit, and the white the most recent. Bones and feathers of birds, together with crystalline deposits, are found amongst the layers of excrement. A large portion of the so-called Peruvian guano is imported from the Chincha islands. These islands, which are three in number, are respectively about five or six miles in circumference, composed of granite, and covered with guano, in some places to a height of 200 feet. No earthy matter is mixed with this great accumulation of excrement. During the last few years, the export of guano has increased considerably. In chemical analysis, guano shows that one of the most, if not the most important, of its constituents is ammonia: some varieties contain from 17 to 20 per cent. Guano also contains potash and a considerable quantity of chloride of sodium (common salt). Earthy phosphates average from 22 to 30 per cent.

GUARANA, or BRAZILIAN COCOA. (*See* PAULLINIA.)

GUAREA, *gwa'-re-a.*—A genus of tropical American trees of the natural order *Meliaceæ*. One species (*G. grandifolia*), a native of the West Indies, is known as Musk-wood, from the odour of the bark. The bark of some of the species possesses medicinal qualities.

GUAVA. (*See* PSIDIUM.)

GUDGEON, *gud'-je-on* (Fr., *goujon*), a fresh-water fish (*Cyprinus Gobio*) inhabiting the waters of English rivers, as the Thames, Mersey, Avon, Kennet, and Colne, which produce remarkably fine specimens. The gudgeon is about six to eight inches long, and half-cylindrical in shape; its back is pale brown spotted with black, the belly white, and the tail forked. The gudgeon swims in shoals, and feeds on worms and aquatic insects. The gudgeon spawns in May, generally in shallow water.

GUELDER ROSE. (*See* VIBURNUM.)

GUIANA BARK, *ge-an'-a.*—A valuable febrifuge obtained from the bark of a tree of the natural order *Cinchonaceæ* a native of Guiana.

GUILLEMOT, *geel'-mot.*—A genus of web-footed birds (*Uria*) of the family of the Divers. The common Guillemot (*U. troile*), popularly known as the "foolish," from the ease with which it is captured, abounds in the Artic regions, and is very common on the English coasts. It is about 18 inches long. The black guillemot is a smaller species, sometimes known as the Greenland Dove. Several species are met with in the North Pacific Ocean.

GUINEA CORN. (*See* DURRA.)

GUINEA FOWL. (*See* FOWL.)

GUINEA GRASS. (*See* MILLET.)

GUINEA PIG.—A small animal (*Cavia cobaya*) of the genus *Rodentia*, a native of South America, but which is now quite domesticated in Europe. It is one of the species called agoutis, which are well known in South America and the West-India islands. Its ears are large and broad; the upper lip is divided in two, and the hair or fur is erect, and somewhat resembling that of a pig (whence its name). The colour of the guinea-pig is generally white, with black spots, although this is somewhat variegated by orange blotches on the coat. It has five toes on the fore legs and three on the hind ones, and it is utterly destitute of tail. The guinea-pig, in its wild state, inhabits dry sandy places, and its flesh is esteemed a great dainty by the natives of South America.

GUINEA-WORM. (*See* FLARIA.)

GULF STREAM. (*See* OCEAN CURRENTS.)

GULF-WEED. (*See* SARGASSUM.)

GULIELMA, *gool-i-el'-ma.*—A genus of palms, natives of Peru and New Granada. One species (*G. speciosa*) is sometimes known as the Peach Palm.

GULL, *gull* (Welsh, *guylan*), a genus of web-footed aquatic birds (*Laurus*), of the family *Laridæ*, dispersed over every part of the globe. Their characteristics are as follows:—A strong straight bill; the body clothed with a great quantity of down and feathers, which give these birds an appearance of greater bulk than their weight warrants; their legs are small and naked above the knees, and the feet are webbed. The gulls, which are seen on the different coasts, mostly assemble in flocks, and are characterised by the greediness and gluttony which seems natural to all sea-birds. There are several varieties of the gull. The common gull (*Larus canus*) is the most numerous of the different genera. It generally measures about seventeen inches in length, by thirty-six in breadth, and it frequents the ledges of cliffs which overhang the sea round the coast. The bill is yellow, the back grey, the head, neck, tail, and under part of the body perfectly white, and the legs are a dull white, tinged with green. It eats any sort of carrion which comes in its way, but its more general diet is fish, which it catches whenever in want of food. The black-backed gull, the ivory gull, and the horny gull have but little distinction from the common gull. The *skua gull* is about the size of a raven; the back and head, and upper parts of the body, are of a deep brown colour, the under parts pale ashy grey; the legs black and the talons very strong and hooked. It is a native of the North, although occasionally found in England. It is a very formidable bird, and not only feeds on fish, but it also preys on lambs and other small animals. In the Shetland isles, and in other northern rock-bound coasts, it is seen often. The *arctic gull* is very similar to the common gull. It never fishes for itself, like other water fowl, but pursues smaller gulls which have captured any booty, and makes them drop it. It then catches its stolen prey before it can reach the water.

GULLET. (*See* ŒSOPHAGUS.)

GUM, *gum* (Sax., *goma*), in Anatomy, is that cellular and elastic fleshy substance which covers the alveolar portions of the upper and lower jaw, and envelops the neck of the teeth.

GUM, *gum* (Fr., *gomme*), a vegetable product, which forms a slimy solution with water, but is insoluble in alcohol, ether, and oils. There are several varieties of gum among them—gum arabic, gum Senegal, gum of the cherry and other stone-fruit trees, gum tragacanth, gum of Bassora, and the gum of seeds and roots. All these gums, except the last, flow spontaneously from the branches and trunks of their trees, and sometimes from the fruits, in the form of a mucilage, which dries and hardens in the air; the gum of seeds and roots, however, requires to be extracted by boiling water. Gum arabic is obtained from the *Acacia arabica*, or *Acacia vera*, which grow upon the banks of the Nile and in Arabia. The commercial gum of this kind consists of a number of small pieces rounded on one side and hollow on the other. It is used in medicine as an adhesive mixture, and also in order to give lustre to crapes and other silk fabrics. Gum Senegal is collected from the *Acacia Senegal*, and is largely used in calico-printing. Gum tragacanth is gathered in Crete and the neighbouring islands, from the *Astragalus Tragacantha*. It is used in calico-printing and by shoemakers. (For other gums, *see* BASSORA GUM, BRITISH GUM, DEXTRIN.) Many other substances called gums are resins or gum-resins.

GUM-TREES. (*See* EUCALYPTUS.)

GUNNERA, *gun'-ner-a* (after Ernest Gunner, a Norwegian botanist), a genus of the natural order *Araliaceæ*. The species *G. scabra*, a native of Chili, is remarkable for its enormous leaves, which are sometimes eight feet across. Its fleshy leaf-stalks, which resemble those of the rhubarbs in appearance, are eaten. Its roots are astringent.

GUNSHOT WOUNDS, *gun'-shot woonds.*—Wounds produced by cannon-balls, bullets, &c., striking against the body. They differ in many respects from ordinary wounds, and require a special treatment. Frequently, on a person being struck, he is not conscious of any pain, and he is first made aware of his wound by inability to use the part, or by feeling the blood trickling down. Generally, if the wound be at all severe, the patient becomes deadly pale, trembles, and seems about to die; but usually, with the aid of stimulants, these appearances pass off in a few hours. If they continue unabated, they give reason to fear the worst. When a ball enters the body, the wound appears somewhat smaller than the ball itself; its edges are ragged and inverted, and the part around has a bluish or black colour from the bruise. When it passes through the part, the aperture by which it makes its exit presents quite a different appearance. It seems somewhat larger than the ball, the edges are everted, and there is little discolouration about the wound. Frequently a ball, if it enter obliquely, or be nearly spent, instead of pursuing a straight course, becomes deflected, and may be found lodged in, or may pass out at a part at a considerable distance from that at which it entered. It is well to examine the wound as early as possible, in order to ascertain the amount of injury; at least, so far as this can be done without aggravating the case. The ball or other foreign substance ought to be removed, if that can be easily effected; but otherwise they ought, in the meantime, to be let alone. Sometimes they remain embedded in the tissues, without producing much or any inconvenience. If, after the sloughing and suppuration, the ball remains fixed, and if much irritation continues to be excited, and abscesses form about its track, then it may be necessary to find out its seat, and use every means to remove it. The simplest dressings should only at first be applied to the wound; as a piece of linen, spread with some mild ointment, fixed on lightly by strips of adhesive plaster, and covered with a rag kept constantly moist with cold water. The inflammation which precedes suppuration is usually very intense, accompanied with great swelling, heat, and pain of the surrounding parts, and severe constitutional disturbance, fever, sleeplessness, &c. Where the injury is very considerable, it is sometimes necessary to have recourse to amputation.

GURNARD, *gur'-nard.*—A genus (*Trigla*), of acanthopterous marine fishes, of the family *Sclerogenidæ*. There are many species, some common on the coast of Britain. The head is covered with bony plates; the body is round and tapering. One of the best known of the British species is the Red Gurnet, about 16 inches long. The flesh is good.

GUTTA-PERCHA, *gut'-ta pert'-sha* (Lat., *gutta*, a drop).—The concrete juice of the *Isonandra Gutta*, a tree belonging to the family of the *Sapotaceæ*. (*See* ISONANDRA.) It grows abundantly in Singapore, Borneo, and other islands of the Eastern Archipelago. The tree, which is called *percha*, grows to the diameter of five or six feet, and, on being notched, yields a milky juice, which solidifies after exposure to the air, forming the gutta-percha of commerce.

GUTTA SERENA. (*See* AMAUROSIS.)

GUTTIFERÆ, OR CLUSIACEÆ, *gut-tif'-e-re* (Lat., *gutta*, a drop; *fero*, I bear), the Gamboge or Mangosteen family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*, consisting of tropical trees and shrubs. The larger proportions of the plants of this order are natives of South America, but a few occur in Madagascar, and on the African continent. There are 32 genera, including about 150 species. They are chiefly remarkable for yielding a yellow gum-resin of an acrid and purgative nature. In many cases, however, the fruits are edible, and are held in high estimation for their delicious flavour.

GWYNIAD, *gwin'-e-ad*, a fish belonging to the British species of Coregonus, sometimes known as the Fresh-water Herring. (*See* COREGONUS.)

GYMNEMA, *jim-ne'-ma* (Greek, *gumnos*, naked; *nema*, filament), a genus of the natural order *Asclepiadaceæ*. The species *G. lactifera*, a native of Ceylon, yields a nutritious milk, which is used as human food. It is called, on this account, the cow-plant.

GYMNETRUS, *jim-ne'-trus.*—A genus of acanthopterous fishes of the Ribbon-fish family. They inhabit great depths, and are rarely taken. A fish of this species, more than 16 feet long, has been captured, and it has been suggested that their appearance has given rise to the stories about the great sea-serpent.

GYMNOGENS, *jim'-no-jens* (Gr., *gumnos*, naked; *gennao*, I produce), a term applied by some botanists to those plants which are distinguished by having the seeds naked, or uninclosed by seed-vessels.

GYMNOSOMATA, *jim-no-som'-a-ta.*—An order of molluscs, destitute of shell, swimming by fins, and having distinct heads. The *clioborealis* is the best known example.

GYMNOTUS ELECTRICUS. (*See* ELECTRICAL EEL.)

GYNANDROUS. (*See* GYNOSTEMIUM.)

GYNŒCIUM, *je-ne'-sheem* (Gr., *gune*, female; *oikos*, house), a term applied to the female or pistilline organs of a flowering plant taken collectively. (*See* PISTIL.)

GYNOSTEMIUM, *jin-os-te'-me-um* (Gr., *gune*, female; *stemma*, crown), a column formed in the centre of a flower by the complete union of the upper parts of the stamens and the pistil. Examples are afforded by the orchis and birthwort. Flowers that show this peculiar union are said to be *gynandrous*.

GYPSEY WORT.—A perennial plant *Lycopus Europæus*), of the natural order *Labiatæ*. It has a stem about two feet high, and small whitish flowers with purple dots, and grows in ditches and moist places. A black dye is obtained from the juice, and it is popularly supposed that gypsies use it to stain their skin—hence the name. The plant has some value as a febrifuge.

GYPSOPHILA. (*See* CARYOPHYLLACEÆ.)

GYPSUM, *jip'-sum* (Lat.), a term applied to amorphous sulphate of lime, from which plaster of Paris is made. It is also found in crystals as *selenite*, in compact semi-transparent masses as alabaster. It has evidently been formed by the decomposition of the iron pyrites, giving rise to sulphuric acid, which, uniting with the chalk, formed sulphate of lime. It is found in many places above the chalk, and sometimes occurs in beds many feet thick. Plaster of Paris is made by heating gypsum to about 250° Fahr., and powdering the calcined mass. Gypsum is also used as a manure. The addition of 1 or 2 per cent. of many salts, such as alum, sulphate of potash, or borax, confers upon gypsum the property of setting slowly into a mass capable of receiving a very high polish. Alabaster is a fine variety of uncrystallized and untransparent gypsum. (*See* ALABASTER.)

GYR-FALCON. (*See* GER-FALCON.)

GYRINIDÆ, *ji-ri-ni'-de*.—A family of small coleopterous insects closely allied to the water-beetles, but differing in having shorter antennæ, and larger fore-legs. The colours are generally of metallic brilliancy. They fly, swim, and dive well, and in the water move rapidly in circles; whence they are popularly known as "whirligigs." The most common British species (*Gyrinus natator*) is about a quarter of an inch long, and of a shiny black colour.

GYROPHORA, *je-rof'-o-ra*, a genus of lichens, several species of which possess nutritrive properties, and are used as food in the arctic regions. They have been denominated *tripe de roche* (rock tripe). The species *G. pustulata* is one of the lichens used in this country by the manufacturers of orchil and cudbear.

H.

HADDOCK, *had'-dock* (Irish, *codog*), a sub-brachial malacopterygious fish, belonging to the family *Gadidæ*. It is almost as well known, according to Yarrell, as the cod; and from the quantity taken of it at numerous localities around our coast, and the facility with which the flesh can be preserved, it is valuable. The haddock swims in immense shoals, which are in the habit of entirely changing their stations when they visit our coast. There is a popular legend that the haddock is the *asinus*, or *onos*, of the ancients; and there is a superstition which ascribes the dark stripes over the shoulders of this fish to the impression left by St. Peter when he took the tribute-money out of the mouth of one of its species: unfortunately, however, for this legend, the haddock does not exist in the Sea of Galilee, which is fresh water. The length of the haddock is generally about twenty inches. The body is lance-shape, and the head slopes suddenly from the crown to the point of the nose, which latter projects beyond the mouth. The colour is throughout a dullish grey, with the exception of the belly, which is white.

HÆMANTHUS, *he-man'-thus* (Gr., *hamia*, blood; *anthos*, flower).—A genus of the natural order *Amaryllidaceæ*. The juice of *H. toxicarius* is extremely poisonous, and is used by the Hottentots to poison their arrow-heads.

HÆMATEMESIS, *he-ma-tem'-e-sis* (Gr., *haima*, blood, and *emesis*, a vomiting).—The vomiting of blood from the stomach. An individual, previously perhaps, to appearance, in robust health, after some strong mental emotion or physical exertion, is suddenly seized with a sense of fulness of the stomach and sickness, when he speedily ejects by vomiting a quantity of blood. The blood proceeding from the stomach is to be distinguished from that coming from the lungs, and will be known by its being almost always of a dark colour, while that proceeding from the lungs is generally bright and florid. Hæmatemesis may exist and yet no blood be ejected; for it may come in small quantities and pass through the alimentary canal; it may also proceed from the fæces, mouth, or nostrils. It may result from various causes; as (1), it may be idiopathic; (2), it may be vicarious of some other habitual hæmorrhage; (3), it may depend upon disease or injury of the stomach itself; (4), it may be the consequence of disease situate elsewhere, and producing mechanically a plethora of the veins of the stomach; (5), it may result from a morbid condition of the blood, and form one symptom of a more general disease.

HÆMATIN, *he'-ma-tin*.—The true colouring principle of the blood.

HÆMATITE, OR HEMATITE, *he'-ma-tite*, one of the most important iron ores. There are two kinds of hæmatite—the red, which is an anhydrous peroxide of iron, and the brown, which is the peroxide in a state of hydration. (*See* IRON ORES.)

HÆMATOXYLON, *he-ma-toks'-e-lon*.—A genus of the natural order, *Leguminosæ*, sub-order *Cæsalpineæ*. The species *H. campechianum* is a shrub of sub-tropical America. The wood, commonly known under the name of *logwood*, is employed in dyeing. Powdered logwood is mixed with sand and digested for several days in pure ether. The deposit is filtered and evaporated until it forms a syrup, when it is set aside to crystallize. In a few days hæmatoxylon is deposited in straw-yellow crystals, which form a solution that assumes a brilliant red colour under the influence of alkalies or oxygen. It is also an astringent and tonic in medicine. It contains crystalline colouring principles called *hæmatin* and *hæmatoxylin*.

HÆMATOZOA *he-ma-to-zo'-a*.—The animalcules, or entozoa, which exist in the blood of mammals, birds, reptiles, fishes, and many invertebrate animals. They are generally microscopic, without generative organs, and found existing in the blood circulating both in the arteries and veins. A very small proportion attain a large size and have organs of reproduction; these are generally found in some special part of the body. The presence of hæmatozoa does not seem to affect the general health of either men or the other animals.

HÆMODORACEÆ, *he-mo-do-rai'-se-e*.—The Blood-root family, a natural order of *Monocotyledones*, sub-class *Petaloideæ*, consisting of herbs or rarely shrubby plants. Natives of America, the Cape of Good Hope, and Australia. The roots of several species of the typical genus

Hæmodorum are roasted and eaten by the natives of certain parts of Australia. They contain a red colouring matter. The blood-red root of *Lachnanthes tinctoria*, a plant of this order, is used for dyeing in North America.

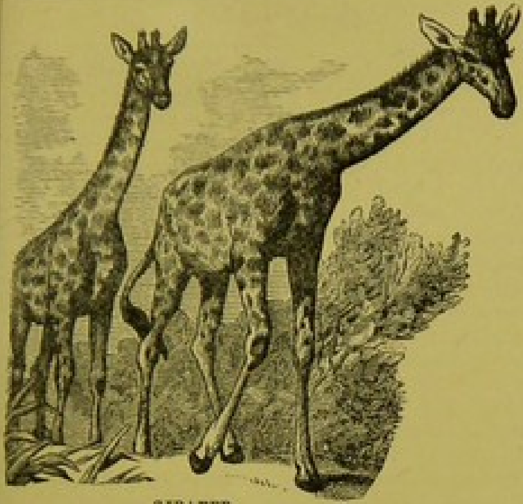
HÆMOPTYSIS, *he-mop'-te-sis* (Gr., spitting of blood).—A term generally used to signify the expectoration of blood from the lungs and air tubes. Bleeding from the lungs may occur without organic disease in plethoric and robust individuals living a life of excitement and excess, and in nervous, irritable individuals weakened by mental or bodily fatigue, and leading sedentary lives. It is often hereditary, and may be brought on by violent muscular effort, paroxysms of cough, blows or pressure on the chest, inspiration of irritating vapours, or of rarified air on high mountains. An attack is frequently announced by a feeling of heat and oppression in the chest behind the sternum, followed by a cough, which brings up the blood. When the quantity is very great, it pours forth without cough, and almost by an act of vomiting, with considerable spasmodic effort. In all such cases, it is best to seek medical advice as early as possible.

HÆMORRHAGE, *he'-mor-raij*.—An escape of blood from some of the vessels of the body. The most common cause of hæmorrhage is external violence, by which the blood-vessels of a part are divided. When an artery of some size is thus injured, a continuous stream of bright red blood is projected with a force proportioned to the size of the vessel, and with a motion corresponding with the pulsations of the heart. If a vein, on the other hand, be injured, the blood is of a dark crimson colour, and the flow is continuous and equable, with much less force than from an artery. Where merely a number of capillaries are injured, the blood flows in a more or less rapid oozing from the wound, but without being projected to any distance from the body. When blood gushes out from internal parts, through any of the natural apertures of the body, the person is commonly said to have "burst a blood-vessel." This, however, is very rarely the case. If there be any rupture, it is usually only of the minute capillaries; but even of this there is often no palpable evidence. Blood may exude abundantly from a surface which presents, to the naked eye at least, no appreciable injury or change. There are even well-authenticated instances on record of cutaneous hæmorrhage, where a dew of blood has appeared upon some portion of the skin, and been wiped away, and re-appeared again and again, without any discernible change of the affected surface, beyond some occasional variation of its colour. There are also what are termed "habitual hæmorrhages," as from the nostrils, &c., which takes place periodically with certain individuals, and belong to the original constitution of the body, and can scarcely be regarded as disease. Active hæmorrhage occurs principally in persons who are young and robust, who live well and lead indolent lives; and is for the most part, to be regarded as an effort of nature to cure itself. It is followed by morbid consequences only when the quantity has been excessive, or when it inflicts some mechanical injury upon the parts along which the blood passes.

HÆMORRHOIDS, OR PILES, *he'-mor-roydz*.—A disease of the rectum and anus, accompanied or followed by tumours in those parts, or by a flow of blood from them recurring after intervals, and sometimes periodically. It is usual to apply the term either to a simple bleeding from the veins of the lower part of the rectum, recurring more or less frequently, yet not accompanied with any distinguishable tumours, either within or outside of the anus; or else swellings formed by a varicose distension and morbid thickening of those vessels, either with or without occasional hæmorrhage; or, lastly, tumours originally produced by effused blood, but subsequently converted into an organized substance. They are distinguished into external and internal piles, according as they are situated outside of or within the anus; and into *blind*, or such as do not bleed; and *open*, or such as are subject to occasional hæmorrhage. The tumours vary greatly in size and form, some of them being hardly as large as a pea, others as large as a walnut or apple. They are sometimes attended with great pain. They may be caused by anything which is capable of retarding the return of blood through the hæmorrhoidal veins. The pressure of the gravid uterus, costiveness, and the frequent retention of hardened fæces in the rectum, are frequent causes. Persons of sedentary habits are often troubled with this disease. In its treatment it is of importance that the bowels be kept open by gentle laxative medicines, as castor oil; and great benefit wlll often be derived from the application of warm water to the part, or from sitting over a steam of warm water.

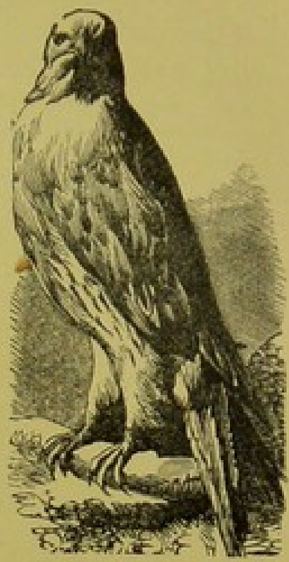
HAIL, *hail* (Sax., *hægel*), drops of rain converted into pellets of ice, by a great and sudden reduction in the temperature of the region in which these raindrops have been forming, by means of the gradual condensation of the watery vapour of the atmosphere. A very cold current of air acting suddenly on vapour which has not quite attained that condition from which it would pass rapidly into the form of drops of rain, would cause the vapour to freeze, and fall to the ground as snow; but supposing that this vapour had just reached that point of saturation and condensation at which it would assume the form of rain, and was on the point of falling in that shape, the action of intensely cold air would cause it to turn into globules of ice in its descent, and reach the earth in that state. The formation of hail, therefore, may be considered to be the consequence of the sudden influence of a very cold current of air on a mass of vapour at rest, and nearly approaching that state of saturation which immediately precedes its conversion into rain. Hailstorms are always attended with wind, and are usually followed by a heavy fall of rain. The barometer also falls suddenly to a considerable extent immediately before a hailstorm, which is frequently accompanied by thunder and lightning. Showers of hail are of short duration, very seldom lasting as long as a quarter of an hour. The clouds from which hailstones fall are considered to be of great extent and depth, on account of the great obscurity which they produce. Hailstorms are generally confined to a limited area, although they are occasionally known to sweep across the face of a country in a long narrow track. Hailstorms have frequently caused great damage in various parts of England. They are of most frequent occurrence in the months of June and July.

HAIMATURIA, *hai-ma-tu'-re-a*, a discharge of blood with the urine, owing usually to a diseased state of the kidneys or bladder. It is



GIRAFFE.

HIBISCUS.



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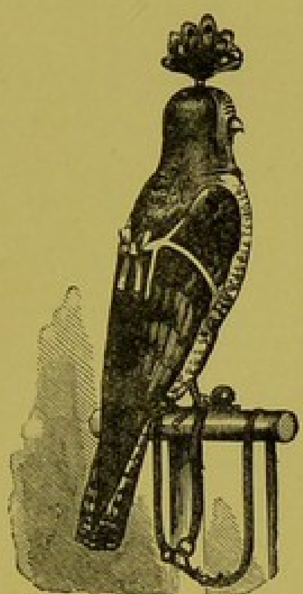


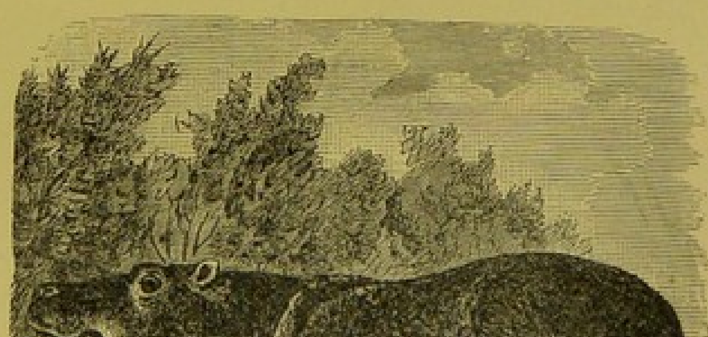
HAWK HOODED.

HENNA.

HEMLOCK.

HERON.

HORSE CHESTNUT-TREE.



HIPPOPOTAMUS.

usually a symptom of some other disease, upon the nature of which its treatment in general depends.

HAIR, *hair* (Sax., *hær*; Ger., *haar*), the small cylindrical, transparent, insensible, and elastic filaments which arise from the skin, and are attached to it by means of small roots. Hair is found to grow on all parts of the surface of the human body except the palms of the hands and the soles of the feet. Hair, being a bad conductor of heat, serves to keep the surface of the body warm, as well as to protect it from the influence of external heat, moisture, and electricity: it thus performs an important part in the animal economy. Hair differs considerably in length, thickness, shape, and colour, according to situation, age, sex, family, or race. A hair is composed of two parts—a shaft and a bulb; the former being that part which rises above the surface of the skin, the latter that which is inserted in the skin. The bulb is inserted in a follicle in the cutis or true skin, the follicle being, like the hair which is inside of it, bulbous, or larger at the lower part. The hair grows from the bottom of the follicle, being formed by the secretions of cells which line the sides of the follicles. Hair is composed of an outer cortical, fibrous or horny substance, which invests it, and an inner medullary or pith-like substance within. The cortex or bark of the hair is composed of a single layer of cells, which overlap each other and give a serrated appearance to the hair when seen under the microscope. The central portion is made up of a series of cells filled with pigment. The colour of the hair seems to depend on the presence of a peculiar oil, which is of a blackish-green colour in dark hair, blood-red in red hair, and nearly colourless in white hair. The grey hair which attends old age is the result of a deficient supply of pigment. Well-authenticated cases are given even of young persons whose hair has become grey even in a single night, in consequence of some strong mental excitement; as fear, sorrow, &c. Some races and persons are noted for the length and luxuriance of their hair, while in others it is very deficient. In some races, as the Kurilian, it grows nearly the length of the whole body. (*See* BEARD.)

HAIR-TAIL.—A genus (*Trichiurus*) of acanthopterous fishes, of the family *Scomberidæ*. They bear some resemblance to the Ribbon-fish. Some species attain a length of 12 feet. An East Indian species (*T. Savala*) is eaten as a delicacy.

HAKE, *haik* (Ang.-Sax.).—A species of fish (*Merlucius Vulgaris*, or sea-pike) belonging to the *Gadidæ* or Cod family. Its generic characters are, head flattened; body elongated; the back furnished with two dorsal fins, the first short and the second long; one anal fin, and no barbule at the chin. It inhabits the seas of north Europe and the Mediterranean, and, although somewhat scarce off the coast of Scotland, it is found most abundantly along the southern coast of England, Portsmouth receiving the greatest supply of this fish. It is a voracious fish, as its systematic name implies. The colour of the hake is a dusky brown on the upper part of the body, with a lighter shade of the same colour below; the dorsal and caudal fins dark, and the ventral and anal fins pale brown. It is a coarse fish, but, on account of its cheapness, much eaten by the poorer classes.

HALCYONIDÆ. (*See* KINGFISHER.)

HALIBUT, *hal'-e-but*, a fish belonging to the family *Planidæ* and the genus *Hippoglossus*. The genus is characterized by a flat, oblong body, compressed vertically; the eyes and coloured surface are on the right side; both jaws and the pharynx are armed with strong teeth. The common species grows to a length of from three to six feet, varying in weight from 100 to 500 lb. It is found on the northern Atlantic coast of America, and also on the northern shores of Europe. It is an exceedingly voracious fish. The flesh is white and firm, but has little flavour.

HALIOTIS, *hal-e-o'-tis*.—A genus of gasteropodus molluscs of the order *Scutibranchiata*. It adheres to rocks, and exhibits great beauty of colour. There are numerous species, mostly natives of warm climates. One (*H. tuberculata*), found on the coast of southern Europe, is used for food, and the shells, known as ear-shells, are valued for ornamental purposes.

HALLEY'S COMET. (*See* COMET.)

HALO, *hai'-lo* (Gr., *halos*, a circle), the name given to a luminous circle that occasionally surrounds the sun, moon, planets, and fixed stars. It is sometimes white, and sometimes faintly tinged with colours like the rainbow. Most commonly but one ring only is seen encircling the heavenly body, but at times the halo assumes the form of several concentric rings of light. There are many theories with regard to the formation of halos, which appear to arise from the double refraction of the rays of light proceeding from any heavenly body, on their passage through thin clouds and aqueous vapour, or from the transmission of the light of these bodies through particles of hail or snow. The name *corona* is frequently applied to these phenomena.

Haloscope.—An optical instrument, consisting mainly of prisms revolving rapidly on a vertical axis, by which the phenomena connected with halos and parhelia can be exhibited.

HALOGENS, *hai'-lo-jens* (Gr., *hals*, a salt; *gennao*, I produce).—A natural group of non-metallic elements, which form direct saline compounds with the metals. They are chlorine, bromine, iodine, and fluorine. Odling defines halogens as those non-metallic elements which unite with hydrogen, volume for volume.

Haloid-Salt, *hal-oid'*, is salt formed by the union of a halogen with a metal, as common salt or chloride of sodium.

HALORAGACEÆ, *hal-er-ai-gai'-se-e*.—The Mare's-tail, or Water-chestnut family, a small natural order of *Dicotyledones*, sub-class *Calycifloræ*, consisting of herbs or shrubs, generally aquatic, with small flowers, which are frequently incomplete and unisexual. The order is nearly allied to the order *Onagraceæ*. The most interesting genus is *Trapa* (which *see*); the other genera are of little importance.

HAMAMELIDACEÆ, *ham-ma-me-li-dai'-se-e* (Gr., *hamameles*).—The Witch-hazel family, a natural order of *Dicotyledones*, sub-class *Calycifloræ*, consisting of small trees and shrubs, natives of North America, China, Japan, the central parts of Asia, Madagascar, and South Africa. *Hamamelis virginica* produces oily edible seeds; its bark and leaves possess astringent properties. *Rhodoleia Championi*, a

Chinese plant of this order, has very showy flowers.

HAMMER-HEAD.—A common name of a genus of fishes of the shark family. The hammer-head (*Zygena*) has a most extraordinary head, resulting, in the full grown fish, a double headed hammer, with the eyes at the ends of the lateral extensions. They are most abundant in tropical seas, are sometimes 12 feet long, and are oviparous.

HAMSTER, *ham'-ster.*—A genus (*Criscetus*) of rodent quadrupeds of the family *Muridæ*, similar to the rat, except that it is larger and has cheek-pouches, and a very short hairy tail. It is generally of a reddish-grey colour, with white feet and white patches on the sides, throat, and breast. It is a native of the north of Europe and Asia.

HANCHINAL, *han'-ki-nal.*—A plant of the natural order *Lythaceæ*, a native of Mexico, and valued for its medicinal property, being a powerful sudorific and diuretic.

HANCORNIA, *han-kor'-ne-a.*—A genus of the natural order *Apocynaceæ*. The species *H. speciosa*, a native of Brazil, bears a very delicious fruit.

HAND, *hand* (Ger., *hand;* Lat., *manus*), is the lower portion of the superior extremity, the great organ of touch and prehension. "In many respects," says Dr. George Wilson, "the origin of touch, as embodied in the hand, is the most wonderful of the senses. The organs of the other senses are passive ; the organ of touch alone is active." The hand is that which distinguishes man in the class of mammals, he being the only animal possessed of two hands (*bimana*). That which constitutes the hand, properly so called, is the power of opposing the thumb to the other fingers, so as to seize upon the most minute objects. The hand is composed of a number of small bones, twenty-seven in all, so arranged as to combine the greatest possible degree both of strength and flexibility. These are arranged in three divisions—those of the carpus, metacarpus, and phalanges. The carpus, or wrist, comprises eight bones, arranged in two rows, four in each. The metacarpal bones are five in number, and constitute the bones of the palm and back of the hand. The phalangeal bones are fourteen in number, three for each of the four fingers, and two for the thumb. They are named in their numerical order from above downwards—*i.e.*, from the palm of the hand. Besides these there are the various muscles of the hand, which give to it its several motions of flexion, extension, abduction, adduction, and circumduction. The hand is also richly supplied with blood-vessels and nerves..

HAND-PLANT. (*See* CHEIROSTEMON.)

HARDNESS, *hard'-ness* (Ang.-Sax.), a term applied to that condition of the force of cohesion in solids, which enables their constituent molecules to retain their relative position, and resist any physical force which tends to alter the figure of the body. Hardness is entirely different from density ; for, although gold and platinum are denser than glass, yet glass is harder than gold or platinum. Iron and zinc are lighter, but harder, than gold or platinum. Some metals are rendered hard with great readiness. This is of inestimable value in the manufacture of steel especially, which can be varied in hardness by heating suddenly, cooling, and then tempering. Hardness is often accompanied by brittleness ; but this can generally be overcome by heating and slow cooling ; this process, however, often takes away from the hardness. Copper and tin, neither of which is remarkable for hardness or elasticity, possess both these qualities when combined ; in which form they constitute bell-metal.

Hardness of Minerals.—Mineralogists are accustomed to divide minerals into ten classes, according to their hardness, diamond being at one end of the scale and talc at the other. Their hardness is tested by their capability of being scratched, or of scratching the minerals, in the following table :—Talc 1, rock-salt 2, calc spar 3, fluor spar 4, apatite 5, adularia felspar 6, rock crystal 7, topaz 8, corundum 9, diamond 10.

HARE, *hair* (Sax., *hara;* Lat., *lepus*), one of the *Leporidæ*, a family of mammalia belonging to the order *Rodentia*, or *Glires*, and characterized by having two small teeth behind the upper cutters, and five rootless grinders, each formed of two plates in both jaws. Hares have large lustrous eyes placed laterally, long ears, a hairy tongue, an incomplete clavicle, weak forefeet, and a very short hairy tail. In disposition, they are gentle, timid animals, and, being possessed of remarkably quick hearing, are frightened at the least noise. Their mode of progression mostly is by a series of leaps, and their flight, when alarmed, is rapid in the extreme. They live on vegetable food, as the young shoots and bark of trees, growing corn, and other similar substances. They are very prolific ; and were it not for the multitudes which are annually shot or otherwise slaughtered for the London market, they would soon overrun the country. Hares form a great object for pursuit on the part of sportsmen ; and hunting them with the greyhound is termed "coursing." (*See* GREYHOUND.) They exist in Europe, America, Asia Minor, Syria, and, in fact, in nearly all countries ; and of course there are many varieties of their conformation. The young are called *leverets*, and the nest of a hare, or the place in which it reposes during the day, is termed its "form." The mountain, or variable hare (*L. variabilis*), is found in the northern parts of Europe and Asia, and also on the Alps, the Pyrenees, and the Bavarian highlands. Its chief peculiarity is that in winter the colour of its fur changes to white. The Arctic hare (*L. glacialis*) is white in winter, but it is brownish-grey in summer. It is larger than the common hare. In this country the hare is considered game, and is protected by the game-laws, and must be sold only by licensed persons.

HAREBELL. (*See* CAMPANULA.)

HARE-LIP (Lat., *labium leporinum*).—A congenital malformation of the lip, named from its fancied resemblance to the lip of a hare. It is a cleft or division of one or both lips, but usually the upper. Sometimes there is a considerable space between the parts, and occasionally the cleft is double, there being a little lobe, or small portion of the lip, between the two fissures. Sometimes, also, the fissures extend through the bones of the mouth. The operation for hare-lip consists in paring off the edge of the separated parts on each side, and bringing the two new surfaces together, so as to close up the fissure, retaining them in their places by means of ligatures.

HARE'S EAR.—A genus of plants (*Bupleu-*

rum) of the natural order *Umbelliferæ*. The common Bubil species (*B. rotundefolium*) grows in corn fields in a chalky soil; the old herbalists called it Thoroughway, and considered it to be useful for the cure of wounds.

HARICOTS. (*See* PHASEOLUS.)

HARLEQUIN DUCK.—A species of Ganot, peculiar for its variegated markings. It is a native of the Arctic regions, but occasionally visits the British islands in winter.

HARMATTAN, *har-mat'-tan.*—A dry, hot wind, similar to the Sirocco of Italy, prevalent on the coast of Guinea, during December, January, and February, blowing from the interior to the Atlantic.

HARP-SHELL.—A genus of gasteropodus molluscs (*Harpa*), of the whelk family. They are found in the tropical seas. The colours of the shell are very brilliant and delicate.

HARPY EAGLE.—A name given to a large bird of South America, the *Harpyia destructor*, remarkable for its formidable beak and talons. The feathers of the head can be erected into a ruff and crest. It preys chiefly on the smaller quadrupeds. The colour is dark slate, with grey head and white breast and belly. Unlike most other eagles, it makes its nest in trees.

HARRIER, *har'-e-er* (Ang.-Nor.)—A species of hound employed in hunting the hare. This animal is supposed to be a cross between the fox-hound and the beagle, and is remarkable for its sagacity in tracing, and the boldness with which it pursues its game. The modern harrier in appearance is little more than a dwarf foxhound.

HARRIER.—A genus (*Circus*) of *Falconidæ*, allied to the buzzards, but having slenderer bodies and legs. In flying, they skim along the ground, in pursuit of reptiles and other prey. The largest British species is about 22 inches long.

HART. (*See* DEER.)

HARTEBEEST. (*See* KAAMA.)

HARTOGIA, *har-to'-je-a.*—A genus of trees or shrubs of the natural order *Celestraceæ*. The wood of one species (*H. Capensis*), a native of the Cape of Good Hope, is very hard and of fine quality, superior even to mahogany when polished.

HART'S TONGUE.—A genus of ferns (*Scolopendrium*). A British species (*S. vulgaris*) is common in cold and damp situations. It differs in appearance from every other kind of fern, the fronds being in general quite undivided.

HARVEST MOON.—The moon which during the autumnal months, when near its opposition, rises nearly at the same hour for several evenings towards the end of September. During the time that our satellite is full, and for a few days before and after, in all about a week, there is less difference between the time of her rising on any two successive nights than when she is full in any other month in the year. By this means an additional supply of light is obtained after sunset, during the continuance of these *harvest moons*. In order to gain an insight into this phenomenon, it must be borne in mind that the moon is always opposite to the sun when she is full; that she is full in the signs Pisces and Aries, these being the signs opposite to Virgo and Libra, which the sun passes through in September and October, our harvest months. The reason of there being little difference in the time at which she rises on several consecutive nights, is, that at these periods her orbit is nearly parallel with the horizon. The harvest moons are as regular in southern latitudes as with us in northern latitude, only they happen at different periods of the year.

HASCHISCH. (*See* CANNIBUS.)

HASTINGS SAND, *haste'-ings.*—In Geology, the lower division of the Wealden beds, forming a portion of the lower Cretaceous period. It consists of sand, calcareous grit, clay, and slate, and forms beds in some places 1,000 feet thick. It abounds in fossils, especially of the saurian reptiles.

HAWFINCH. (*See* GROSBEAK.)

HAWK, *hawk* (Sax., *hafoc*), a term applied to the *Accipitrinæ*, a sub-family of the *Falconidæ*. The birds of this family are distinguished by the shortness of their wings, which extend no further than two-thirds the length of their tail. The fourth quill-feather is the longest, the first, second, and third gradually exceeding each other in length. The beak is short, and hooked from the base; and the upper mandible, though not furnished with distinct teeth, like the true falcons, has the festoon, or prominence, that generally supplies its place, more strong and angular than is usual among these tribes. Hawks are generally natives of cold climates; they skim the ground with a low and rapid flight, sometimes seizing their prey upon the wing, and sometimes swooping upon it from above. There are many species, found in nearly all parts of the world. (*See* GOSHAWK and SPARROW-HAWK.)

HAWK-MOTH.—A name sometimes given to the lepidopterous insects of the *Crepuscularia*. Their flight is very powerful and rapid. The name is supposed to have been given from the hovering motions of these moths, resembling the movements of a hawk looking for prey.

HAWKWEED.—A genus of plants (*Hieracum*) of the natural order *Compositæ*. Some species are annual, others perennial. They are found in the temperate and cold regions of the northern hemisphere; and are very common in Britain. The Orange Hawkweed is often cultivated in gardens for the sake of its richly-coloured flower.

HAWTHORN. (*See* CRATÆGUS).

HAY FEVER.—An inflammation of the nostrils and the bronchial mucous membrane, with considerable constitutional disturbance, caused in some persons by the emanation from newly mown hay.

HAZEL. (*See* CORYLUS.)

HEAD. (*See* BRAIN, ANATOMY.)

HEADACHE, *hed'-aik* (Sax., *heafod*, head; *ace*, ache), or pain in the head, is a complaint of very common occurrence, and may result from many different causes. There are few diseases with which it does not occur symptomatically, and it is a prominent symptom in all fevers and inflammations, and in many nervous complaints. It occurs idiopathically, either from weakness, or exhaustion of the nerve-power of the brain, or from a disordered state of the digestive apparatus. Sometimes it is an obtuse pain extending over the whole head, with a sense of heaviness, with a general torpitude of the sensorial power, disqualifying the person for continued mental effort. The sight is often dim, the hearing dull, and the memory defective. This arises from some weakness or exhaustion of the brain, and is produced by irregular circulation of the blood in the head, by great mental exertion, or by violent mental passions. When it arises from an over-loaded condition of the blood-vessels of the brain, there is usually a bloated countenance, full red eye, and a dull inanimate expression. Cold applications to the head, leeches to the temples, or cupping on the back of the neck, with spare diet and active aperients, are the proper means to be adopted in this case. Where it proceeds from a nervous exhaustion or nervous irritability, soothing and strengthening measures are to be adopted, and stimulants to be as much as possible avoided. Tonics ought to be employed, and such other means, as out-door exercise, sea-bathing, &c., as tend to strengthen and invigorate the system. Bilious headache, or such as arises from a disordered state of the digestive organs, usually affects one side of the head only, or but a portion of it, most commonly over one eye, and increasing to an acute and often throbbing pain. In rheumatic headache, which is commonly caused by exposure to cold, the pain is of a remittent, shifting nature, shooting from point to point, and is felt most at night when the patient is warm in bed. (*See* RHEUMATISM.)

HEALTH, *helth* (Ang.-Sax.), is that condition of the living body in which all the vital, natural, and animal functions are performed easily and perfectly, and unattended with pain. It consists in a natural and proper condition and proportion in the functions and structures of the several parts of which the body is composed. The most perfect state of health is generally connected with a certain conformation and structure of the bodily organs, and well marked by certain external signs and figures, a well-proportioned body, calm and regular circulation of the blood, free and full respiration, easy digestion, &c. There are, however, few persons who can be said to enjoy perfect health; and hence, in ordinary language, when we speak of health, we imply merely a freedom from actual disease. Muscular strength and activity, nervous sensibility, and the sensorial powers, vary exceedingly in different individuals, yet all within the limits of health. In order to preserve health, it is necessary to be temperate in food, exercise, and sleep, and to pay strict attention to bodily cleanliness, great moderation in the use of spirituous liquors, and abstinence from the over-indulgence of sensual gratifications.

HEALTH, PUBLIC. (*See* SANITARY SCIENCE.)

HEARING. (*See* EAR, DEAFNESS.)

HEART, *hart* (Sax., *heort*; Lat., *cor*).—The great central organ of the circulation of the blood, a hollow muscular organ in the form of an irregular cone, and placed obliquely in the lower or front part of the thorax, inclined most to the left side. The base is directed towards the spine, and corresponds with the fourth and fifth dorsal vertebræ, while the apex points between the cartilages of the fifth and sixth ribs on the left side. It rests upon the diaphragm, having the lower surface somewhat flattened. It is inclosed in a membranous bag, called the pericardium, but loosely, so as to allow free motion. The heart may be considered as double, the right side being pulmonary, and serving to transmit blood only to the lungs; the other systemic, forcing the blood into all parts of the system. It contains four cavities—two at the base, termed auricles, and two at the apex, named ventricles. The right auricle has four apertures—one from the superior vena cava, by which the blood is returned from the upper portion of the system; one from the inferior vena cava, returning the blood from the lower parts of the system; one from the coronary vein, by which the blood is returned from the heart itself; and one into the right ventricle. The blood passes from the right auricle into the right ventricle, the entrance to which is guarded by a fold of the lining membrane, forming a valve, called the tricuspid, from its presenting three points. The blood is sent from the right ventricle into the pulmonary artery, by means of which it is conveyed to the lungs. The entrance to the pulmonary artery is guarded by three semilunar valves, which prevent the blood from again flowing back into the ventricle. The blood is returned from the lungs to the heart by the pulmonary veins, which convey it into the left auricle. From this it is sent into the left ventricle, the entrance into which is guarded by the mitral, or bicuspid valve, consisting of two pieces, of which the right one is much larger than the other. The left ventricle has its walls much thicker than the right, and forces the blood into the aorta, for distribution over the entire system. At the commencement of the aorta, there are three sigmoid or semilunar valves, as in the pulmonary artery, for preventing the blood from returning. The heart of a fœtus differs from that of an adult, in having a foramen ovale, through which the blood passes from the right auricle to the left. The exterior fibres of the heart are longitudinal, the middle transverse, and the interior oblique. The contraction of the heart is termed systole; its dilatation, diastole.

Diseases of the Heart.—The heart, from the important part which it plays in the animal economy, is subject to various, serious, and often fatal diseases. Like the other viscera, it is removed from the eye, so that little knowledge of its condition can be obtained by inspection; and hence we must have recourse to other means. The ear is the principal means of obtaining a knowledge of the state of the heart, and by auscultation and percussion (which *see*), we are enabled to detect the existence of various diseases. The heart gives out two sounds, known as the first and second, which are distinguished from each other. The first sound is longer than the second, and the interval between the first and second sounds is shorter than that between the second and first. They have been compared to the two syllables *lubb, dup*. Any manifest alteration in these sounds is indicative of the existence of disease. They may be high or low, clear or dull, muffled, rough, intermittent, &c. Murmurs or regurgitant sounds may arise from disease of the valves. The power of distinguishing between the normal and abnormal sounds of the heart, and of the causes producing the latter, can only be obtained by lengthened experience. Diseases of the heart are usually divided into two classes—1, functional or nervous; and 2, structural or organic. Chief among the former are palpitations, syncope, or fainting, and angina pectoris (which *see*). They are chiefly to be met with in persons of a naturally nervous temperament, more especially women suffering from hysteria, or other like complaints, and may be induced by great mental excitement. Among the principal organic diseases to which the heart is subject, are pericarditis, carditis, endocarditis, atrophy, hypertrophy, dilatation, and valvular disease. Pericarditis, or inflammation of the pericardium, may be induced by exposure to damp or cold, or by other causes, which give rise to inflammation in other parts. It is characterized by great tenderness over the region of the heart, amounting, when pressed, to sharp cutting pains, which prevent him from lying upon the left side. Where the disease is rapid and violent, bleeding may be of great service; in other cases tonics, and in some cases stimulants, are employed. Carditis, or inflammation of the heart itself, sometimes occurs, but it is usually accompanied with inflammation of the pericardium: the symptoms in both cases are the same, and the treatment will consequently be similar in both. Atrophy, or a wasting of the heart's substance, arises from a deficiency in the supply of nutritive matter. It is usually accompanied by general emaciation, and will be pretty sure to terminate in death. When the heart is examined after death, its tissues are found to have undergone a change, and, instead of a striped, to present a homogeneous appearance. This is called "fatty degeneration." The treatment is to strengthen the system by tonics, wholesome and nutritious diet, open-air exercise, sea-bathing, and the like. Hypertrophy, on the other hand, is the result of an excess of nutrition, the nutritive process appearing to go on more rapidly than the absorbent. In this way the heart is often greatly enlarged in bulk, and its operations seriously interfered with. It is usually distinguished into three kinds—(1) simple, when the walls of the heart, or its divisions, are thickened, without any diminution in the capacity of the cavities; (2) eccentric, or aneurismal, when the walls are thickened, and the cavities likewise enlarged; and (3) concentric, when the cavities are diminished in proportion to the thickening of the walls. The first of these is the least common, and the second the most frequent and any of them may affect a single cavity or the whole heart. Dilatation of the heart is where one or more of the cavities are enlarged in size without the substance of the heart itself being increased. It is sometimes caused by increased action of the heart, and may be produced by excessive exertion or strong excitement of any kind; it frequently also arises from want of sufficient muscular strength in the heart itself, or from some obstruction to the free passage of the blood. The valves of the heart are subject to a variety of diseases which interfere with their proper action: these are among the most easily detected of the organic diseases, on account of the sounds produced by them. The valves frequently become thickened, or even cartilaginous or osseous, so that they do not act freely or close imperfectly, leading to obstruction or regurgitation of blood.

HEARTBURN, *hart'-burn*, (Lat. *cardialgia*, from Greek, *kardia*, the heart, and *algos*, pain). —An uneasy sensation in the stomach, ascending with acid eructations and a burning heat in the throat. Sometimes it is attended with oppression, faintness, nausea, and an inclination to vomit, or a plentiful discharge of a clear, lympid, fluid-like saliva, commonly termed waterbrash. In some cases a gnawing or burning pain is felt, chiefly at the cardia, or upper orifice of the stomach; whence the name is derived. It is usually a symptom of dyspepsia, but it may also be occasioned by other complaints; as worms, inflammation of the stomach or intestines, various diseases of the heart, &c. It may also be occasioned by violent emotions of the mind.

HEAT, *heat* (Sax., *heat*, *hæt*).—A term applied in ordinary language either to the sensation excited in us by the approximation of a warm body or to the cause of that sensation. Heat, as a great natural agent, is universally diffused through all matter, and is capable of producing various phenomena; such as expansion, fusion, vaporization, and thermo-electric currents. There is nothing absolutely known as to the cause of heat. By those who consider heat to be a material substance, it is called *caloric*, and is supposed to be a subtle fluid universally diffused, and capable of permeating the densest substances. The parts of this fluid are also supposed to be mutually repulsive, but attracted by the material particles of bodies; thus accounting for expansion and contraction. The other effects of heat are accounted for on principles analogous to those on which the undulatory theory of light is founded. Those who regard heat as merely accidental to matter, consider that the artificial production of heat is accompanied by vibratory motions in the interior molecules of the heated substances. This theory is open to a great objection, for heat is propagated through a vacuum; and even if it is supposed that all space is filled with a fluid, in order to account for solar heat, the hypothesis loses its simplicity, and is very vague. It is better to observe the properties of heat, and from them to measure and calculate its effects, than to speculate on its nature; and instead of using the word *caloric* to conceal our ignorance, to use the word heat, in order to denote that state or condition of a body which excites in us the sensation of heat.

Sources of Heat.—Every existing substance may be looked upon as a source of heat. The most important of these is the sun, and its heat, when condensed by means of a lens, is very intense. The second source of heat is mechanical, and consists in the friction or rubbing together of solid substances. In this operation, strong mechanical force is opposed to the force of cohesion or adhesion, and heat is generated by the reaction of the two. Two pieces of wood rubbed rapidly together quickly become hot, and when the force and velocity are great enough combustion ensues, and if two pieces of ice are rubbed together, they will melt as a result of the generated heat. The sparks of the common flint and steel are small particles of the metal struck off by the stone, and burning under the influence of the heat elicited by the blow. Heat results from the friction of fluid, for if water be simply shaken in a bottle the temperature rises nearly two thirds of a degree in about a minute, and, in the case of mercury, the increase is greater. Percussion produces heat, as in the case of a weight raised to a height above the earth's surface and then released when it has struck the earth it is found to be hotter than before. A nail, if violently hammered, becomes red-hot in two minutes. Compression produces heat; during the rolling of metals at the Mint, the bar, after compression, is so hot that water boils upon its surface. By causing a conductor to revolve between the poles of a powerful electro-magnet, Joule proved a considerable development of heat thus resulting from the friction of a metal against the magnetised ethereal medium. A third source of heat is chemical. All cases of common combustion, and all artificial processes for obtaining light and heat, are familiar examples of this action. But in all cases of this sort, the heat evolved, however copious and intense, is limited, and proportionate to the quantities of the substances reacting upon one another. Heat is obtained from a fourth source, which is probably allied to the last; namely, electricity. The heating effects of lightning are well-known. Houses are set on fire, metal rods melted, and sand vitrified by its means. Another source of heat is physiological, and exists in ourselves. Heat is a product of animal life, and we can feel it and judge of it by our own sensations; we can increase it by muscular exertion, and can communicate the sensation of heat to others. When referred to our sensations directly, however, heat and cold become merely comparative terms, and depend upon the temperature of our bodies at the time of experience. Any estimation, therefore, of heat by sensation must be very vague.

Imponderable Heat.—In all these sources of heat, notwithstanding the copious evolution of the wonderful agent, there is no loss of material substance. Solar heat has been concentrated by a number of powerful lenses on one scale of a balance of extreme sensibility; but no derangement of equilibrium ensued. As far as experiment can show, heat must consequently be looked upon as without weight—an imponderable agent.

Radiation and Reflection of Heat.—Heat radiates from all bodies in straight lines and in all directions; and, like radiant light, its intensity decreases as the square of the distance from the source of the rays: thus, if a thermometer protected from the influence of all disturbing causes be observed to rise a certain number of degrees at one inch distance from a heated surface, it will indicate four times less heat at two inches; nine times less at three inches; and so on. Reflected heat also follows the same law as reflected light; and that the angle of reflection is equal to the angle of incidence may be proved by holding a bright metallic plate before a fire. When we see the reflection of the fire, we also feel the heat. If two concave mirrors are fixed at a distance of 10 or 15 feet apart, with their axes in the same line, and their faces parallel and opposed to each other, upon placing a thermometer in the focus of one, it will be found sensitive to the effects of a heated body placed in the focus of the other. A piece of ice placed before one mirror will cause the mercury in the thermometer to descend, not through the radiation of cold, but through the radiation of heat from the thermometer to the piece of ice. The best absorbents of heat are the best radiators, and the best reflectors are the worst radiators.

Expansion by Heat.—The increase of bulk for the same increase of heat varies much in different classes of substances. It is small in solids, larger in liquids, and greatest of all in aëriform bodies. From the freezing to the boiling point of water, 350 cubic inches of lead become 351; 800 cubic inches of iron, 801; and 1,000 cubic inches of glass, 1,001. Liquids augment their volumes in different proportion when subjected to the same change of temperature: but every aëriform substance, provided it be not in contact with a liquid, expands in the same proportion; 1,000 parts of air becoming 1,373, when heated from 32° to 212° Fahrenheit. These expansions take place gradually, and when the heat is withdrawn, the bodies return to their original bulks, by corresponding regular contractions.

Conduction of Heat.—One of the most important properties of heat is conduction. If a stick of charcoal is held in the flame of a candle, no disagreeable sensation of heat will be perceived, even when the heated extremity is at a small distance from the fingers. But a metallic wire will speedily burn the hand at a greater distance from the extremity, and before any part becomes red even. The process by which the heat is conveyed along the metal is called conduction. This property varies in different solids, and it may be roughly stated that dense bodies possess conductive power in the greatest proportion. Thus, metals are the best conductors; stones are next; hard woods next; and so on. Heat is conducted by liquids with such difficulty that some philosophers have doubted whether they are not altogether destitute of the power. They acquire heat, however, under particular circumstances, with such facility, that it might be hastily concluded that they possess the power of conduction in an eminent degree. That liquids conduct heat very imperfectly, can easily be proved by experiment. If a glass tube, four or five inches in length, be nearly filled with water, and the upper part be heated in a spirit-lamp, the water will boil on the surface, while the tube can be held in the hand at the lower end, without inconvenience, as the water is not able to conduct the heat downwards. In all such experiments, however, the heat is ultimately conveyed down the solid sides of the containing vessel. The difficulty of determining the power of conduction in aëriform bodies is much greater than that of liquids. It has never been proved that they are capable of conducting heat at all. A simple experiment will show the comparative powers of conduction of solid, liquid, and aëriform bodies. Metals, when heated to 120°, will severely burn a hand placed upon them, on account of the facility with which the heat travels towards it. Water will not scald, provided the hand be kept without motion in it, till it reaches the temperature of 150°; while the contact of air can be endured at 300°. Although heat travels by conduction with difficulty through liquid and aëriform bodies, both these classes of substances speedily become heated. This is effected by processes of circulation, or rapid change in the relative position of adjacent particles; and the operation is called *convection*. When a liquid is heated, it expands and becomes lighter; the heated and lighter particles rise to the surface, and a new portion comes in contact with the source of heat: and so the motion continues as long as the heat continues to be communicated. The same process of convection takes place, but much more rapidly, in elastic fluids.

Latent Heat.—Thus far heat has been treated as a force freely developed, which could be measured by our sensations, and by the thermometer and pyrometer. Heat, however, also enters, as it were, into the composition of bodies, loses its character of temperature, and becomes concealed or *latent* to our instruments and our feelings. When equal volumes of the same fluid, at different temperatures are mixed, they afford the mean temperature of the two. A pint of water at 50°, mixed with a pint at 100°, will show, by the thermometer, a temperature of 75°. If a quantity of mercury, however, at 100°, be mixed with an equal measure of water at 40°, the resulting temperature will be 60°, or 10° lower than the mean; so that the mercury loses 40°, and the water only gains 20°; yet the water must contain all the heat which the mercury has lost. From this it appears that water has a greater capacity for heat than mercury—viz., it requires a larger quantity of heat to raise it to a given temperature. When matter passes from the solid to the liquid state, or from the liquid to the aëriform state, examples are to be found of *latent heat*. In these processes a large quantity of heat is absorbed, combined, or fixed; and in the opposite changes from aëriform to liquid, and from liquid to solid states, a quantity of heat is set free, and becomes sensible. If equal weights of water at 32° and of water at 212° are mixed, they will show a temperature of 122°; but equal weights of ice at 32° and water at 212 form a mixture, the temperature of which is 52°; the water losing 160° of temperature, while the ice only gains 20°. Therefore, 140° of heat are expended in changing from the solid to the liquid state. When liquids pass into the solid state, their latent heat becomes sensible; and by careful management water can be cooled several degrees below its freezing point without congelation; the moment, however, that it is agitated it is made to congeal, and the temperature rises to 32°.

Mechanical Equivalent of Heat.—In 1842 and 1843, Dr. Julius Mayer, of Heilbronn, and Mr. Joule of Manchester, undertook investigations by entirely distinct methods. Mayer's experiments proved that if we have a cubic foot of air at the freezing temperature of water, and under ordinary atmospheric pressure, and if we heat it until we double its volume, this expansion will have produced a certain amount of work, for it will have caused the air to expand against the atmospheric pressure. Now, as the atmospheric pressure on a square inch of surface is, in round numbers, 15 lbs., it follows that the pressure on a square foot is 2,160 lbs. Therefore the heat, which has doubled the volume of the cubic foot of air, has raised 2,160 lbs. through a height of one foot. Joule experimented in another manner. He chose a falling body as his source of mechanical power; the motion was communicated to a spindle wheel was caused to revolve by the unwinding of string from it as the weight descended, and the spindle expended the motion then received in producing friction in various ways, principally by causing a paddle to revolve in water and in mercury. The paddle was enclosed in a circular vessel, carefully protected from receiving extraneous heat, and it contained water at a known temperature. The heat results from the friction of the paddle with the water were measured with great accuracy by the most sensitive thermometers. The result arrived at was that the quantity of heat capable of increasing the temperature of a pound of water by one degree Fahrenheit, requires for its evolution the expenditure of a mechanical force represented by the fall of 772 lbs. through the space of one foot. We have here tangible proof of the direct conversion of the motion of a tangible mass, that is mechanical work, into the motion of intangible molecules, that is heat; and we have the precise relative value in their respective units. The converse of this also takes place, for a given amount of heat truly represents and is capable of being converted into a certain definite amount of mechanical work. A result of this discovery has been the invention of a machine in which heat is transformed to mechanical force. Such a machine consists of a source of heat, a receiver of heat or refrigerator, and a means of conveying heat between them, and it produces work while heat passes from the source to the refrigerator. Sir William Thomson has determined that the fraction of the heat which is coverted into work is directly proportional to the difference of the temperatures of the source and refrigerator, and inversely proportional to the temperature of the source. The fraction of heat available for work is one-fifth.

HEATH, OR HEATHER, *heeth heth'-er* (Sax., *hæth*), in its common signification, means a place or portion of waste land overgrown with shrubs of any kind, or a moor over which the prevailing plants or vegetation consist of one or more of the several species of *heath*, or *erica*. Heaths are common in Scotland, Ireland, some parts of England, and in countries having a similar climate on the Continent; and many hundreds of acres are covered with the *erica*. The burning or setting fire maliciously to a heath in England is felony, and is punished by a term of imprisonment not exceeding three years. (*See* ERICACEÆ.)

HEAVEN, *hev'-en* (Sax., *heafen*).—A term which designates the region or expanse surrounding the earth, and which appears above and around us like an immense arch or vault, wherein the sun and moon, the planets and the constellations, apparently revolve in their orbits. Aristotle and others believed the heavens to be composed of incorruptible materials, as likewise the sun, moon, and stars; which belief was a great drawback to the spread of astronomy, until it was overthrown by the reasonings of Galileo. Ancient astronomers also supposed that there were eight heavens, seven of which were named after the planets, and the eighth called the *firmament* (which *see*).

HECTIC FEVER, *hek'-tik* (Gr., *hektikos*, habitual).—A protracted or habitual fever, and is generally applied to that intermittent fever which usually occurs in the latter stages of consumption. It is commonly characterized by morning and evening paroxysms, with intermediate remissions; but the evening paroxysm is usually the most marked. Towards evening, as the paroxysm comes on, the listless, languid manner which prevailed during the day becomes changed, the eyes brighten, the conversation becomes animated, and the cheeks assume a beautiful flush. This may continue for five or six hours, when the manner and appearance of the patient become entirely changed, the hectic flush passes away, and a chill spreads over the entire frame, followed by a profuse perspiration, which leaves the patient utterly prostrate. The patient is gradually reduced in body and strength, and at length dies exhausted.

HEDEOMA, *he-de-o'-ma* (Gr., *edus*, sweet), in Botany, a genus of the natural order *Labiatæ*. The species *H. pulegioides*, commonly known as American pennyroyal, is much used in the northern states of America as an emmenagogue, and also occasionally as a stimulant and carminative.

HEDERA, *hed'-e-ra*. (*See* IVY.)

HEDGEHOG, *hedj'-hog* (*Erinaceus europæus*).—A genus of animals belonging to the class *Mammalia*, order *Feræ*, and family *Talpidæ*. It is found in most parts of Europe and Asia, and also in South Africa. The hedgehog is known by its body being covered with spines, and its possessing the faculty of rolling itself up into a ball, protected by these same spines, when pursued; and it will not disengage itself until the danger has passed. It is generally about nine inches in length, its muzzle is pointed; its tail short; the head very conical; ears short, broad, and rounded; each foot five-toed, and armed with long claws; eyes prominent; body oblong, and conical on its upper surface; and its legs are short, and nearly destitute of any covering. Its colour is usually of a greyish-brown; and it is a nocturnal animal, while in the winter it burrows in the earth and becomes torpid. Its usual food is composed of beetles, slugs, and snails; and from its fondness for insects, and its nocturnal habits, it is often kept domesticated in London to destroy cockroaches and black-beetles. Its flesh is eaten on the Continent, although few but Gypsies consume it in England.

HEDGE HYSSOP. (*See* GRATIOLA.)

HEDGE MUSTARD.—A genus of plants (*Sisymbrium*) of the natural order *Cruciferæ*, annual or perennial, with small yellow or white flowers, and a long rounded pod. The common hedge mustard (*S. officinalis*) was once employed as a remedy for coughs, and also as a pot-herb. The broad-leaved variety (*S. iris*), or London Rocket, and the Flix-weed (*S. Sophio*), are other species.

HEDGE-SPARROW.—This bird (*Accentor modularis*), also known as the Hedge Warbler and Drinnoch, is a native of Britain and of most parts of Europe. It only resembles the sparrow in its plumage, being smaller and of more slender form.

HEIGHTS, MEASUREMENT OF, *hites* (Ang.-Sax.).—The measurement of elevations above the surface of the earth, or above the level of the sea, may be effected in four different ways; firstly, by trigonometrical calculations and measurements; secondly, by levelling; thirdly, by means of the barometer; and lastly, by observing the difference of temperature at which liquids will boil at different heights. (*See* BOILING-POINTS.) The means used to ascertain the heights of objects by the first and second methods named above are described elsewhere. (*See* LEVELLING, MENSURATION, TRIGONOMETRY.) In measuring heights by the barometer, the differences of temperature and of the force of gravity at different elevations, which must be carefully registered and allowed for in correcting the results obtained by such an operation, if great nicety be required, render it a task of considerable difficulty, involving numerical calculations of great intricacy.

HEISTERIA, *hi-ste'-re-a*, a genus of West-Indian plants of the class *Decandria*, order *Monogynia*, consisting of trees with alternate leaves and small axillary flowers. It received its name in honour of Laurence Heister, of Helmstadt.

HELIACAL, *he-li'-a-kal* (Gr., *helios*, the sun).—When a star appears above the horizon, and becomes visible a short time before sunrise, its rising is said to be heliacal. In the case of a star that is close to the sun's orbit when the sun, by reason of its course along its orbit, is approaching the star, the sun rises after the star, and sets after it; but when the sun has passed the star, and is receding from it, the star begins to rise before the sun, and sets before it. When the sun is approaching the star, and the star becomes visible at its setting, just after sunset, it is said to set heliacally; but when the sun has passed the star, and it is visible at its rising shortly before sunrise, it is said to rise heliacally.

HELIANTHUS, *he-le-an'-thus* (Gr., *helios*, the sun; *anthos*, flower), Sunflower, a genus of the natural order *Compositæ*. The species *H. annuus* is a well-known annual. It is appropriately named the sunflower, as its large circular head of florets, surrounded by golden rays, forms a complete ideal representation of the sun. There are varieties of *H. annuus* with double flowers, the tubular florets being all changed into ligulate ones, like those of the ray. The species *H. tuberosus* produce the tubers known as *Jerusalem artichokes*, which are much eaten, like potatoes. The word Jerusalem is merely a corruption of the Italian *girasole*.

HELIOCENTRIC, *he-le-o-sent'-rik*. — An astronomical term signifying that the sun is taken as the centre. It is opposed to geocentric.

HELIOTROPIUM, *he-le-o-tro'-pe-um* (Gr., *helios*, the sun; *tropeo*, I turn).—The Heliotrope, or Turnsole, a genus of the natural order *Boraginaceæ*. *H. Peruvianum* and *Europæum* are popular plants, with small white or red flowers. They have a delicious odour. The name originated in the Greek fable which represents Clytia as changed into this flower through gazing at Apollo.

In Mineralogy. (*See* BLOODSTONE.)

HELLEBORE. (*See* HELLEBORUS.)

HELLEBORUS, *hel-leb'-o-rus* (Gr., *helein*, to destroy, and *bora*, food for cattle, as indicating its poisonous properties).—A genus of the natural order *Ranunculaceæ*, consisting of perennial herbs with divided leaves, of a paler green and more rigid than in most other plants of the order. The most important species is *H. niger*, the black hellebore, so called from the colour of its roots. It is a native of the shady woods of the lower mountains in many parts of Europe. It flowers in winter, and on this account is sometimes called the white Christmas rose. Hellebore root is imported in bags and barrels from Hamburg, and is used medicinally as a drastic purgative. The species *H. officinalis viridis* and *fœtidus* possess similar properties. The two latter have been found wild in several parts of England.

HELMINTHOLOGY, *hel-min-thol'-o-je* (Greek, *helmons*, a worm; *logos*, a discourse), the science of the natural history of red-blooded worms, as the earth-worm and others.

HELVELLA, *hel-vel'-la*.—A genus of fungi, closely allied to mosels. Some of the species are eaten in Germany.

HEMIDESMUS, *hem-e-des'-mus* (Gr., *hemi*, half; *desmos*, a bond), a genus of the natural order *Asclepiadaceæ*. The root of *H. indicus*, or Indian sarsaparilla, a climbing shrub, has been for some time in use in India, under the name of country sarsaparilla, and was declared by the medical officers of the Madras establishment to be in many cases an efficient substitute for true sarsaparilla.

HEMIOPIA, *hem-e-o'-pe-a* (Greek, *ops*, the eye).—A peculiar and rare disease of the eye, in which the vision is limited to one-half of an object.

HEMIPLEGIA, *hem-ip-le'-ge-a*, (Gr., *plesso*, I strike).—Paralysis limited to one side of the face and body, generally the result of disease of the brain.

HEMIPODE, *hem'-i-pode*.—A genus of small gallinaceous birds (*Hemipodius*), nearly allied to quails, but with more slender beaks. The name, signifying half-footed, was taken from the absence of a hind toe. They are natives of Southern Europe, Africa, and Australia.

HEMIPTERA, *he-mip'-ter-a* (Gr., *hemi*, half; *pteron*, wing), an order of insects having their wing-covers formed of a substance intermediate between the elytra of beetles and the other ordinary membranous wings common to most insects. When the *Hemiptera* quit the egg, they have the appearance of small hexapod larvæ, differing but little from the perfect insect, save in the absence of wings; and before these latter are acquired, the skin is shed several times, and the larvæ acquires a much larger bulk. They are most abundant in hot climates.

HEMISPHERE, *hem'-is-fere* (Gr., *hemi*, half, and *sphaira*, a sphere or globe), the solid obtained by dividing a sphere into two equal parts in the plane of any great circle passing through a diameter of the sphere in any part. In Astronomy, the field of the heavens and the earth is divided into the northern and southern hemispheres, by a plane passing through the equator; and the latter is also divided into the eastern and western hemispheres, by a plane passing through the 30th meridian W. of Greenwich.

HEMLOCK. (*See* CONIUM.)

HEMORRHAGE. (*See* HÆMORRHAGE.)

HENBANE. (*See* HYOSCYAMUS.)

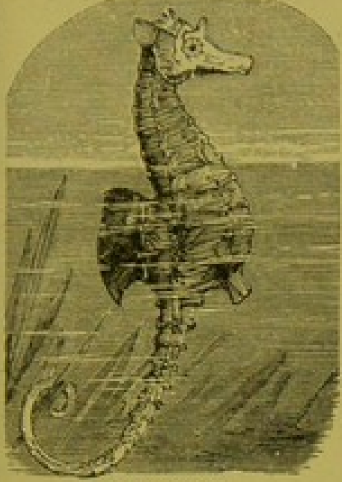
HENNA. (*See* LAWSONIA.)

HENSLOVIACEÆ, *hen-slo-ve-ai'-se-e*. – A small natural order of tropical *Dicotyledones* in the sub-class *Calyciflorœ*. It contains but one genus, consisting of three or four species, which resemble in most respects the hydrangeas, the chief differences being in their tree-like habit, in the union of their styles into a cylinder, and in the total absence of albumen.

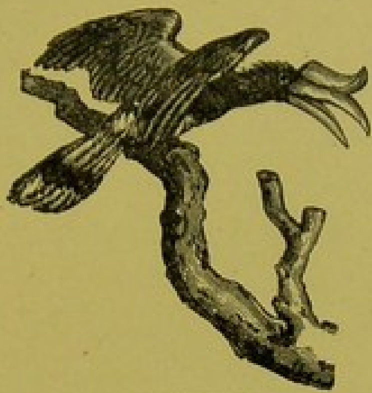
HENWARE. (*See* ALARIA.)

HEPATICACEÆ, *he-pat-e-kai'-se-e* (from Gr. *hepar*, liver). — The Liverworts, a natural order of flowerless plants, sub-class *Acrogenœ*. They are generally diffused over the globe, but they are most abundant in damp, shady places in tropical countries. There are about 65 genera, which comprise upwards of 700 species. Some have been used medicinally in liver complaints, and *Marchantia hemispherica*, and other species, have been employed in the form of poultices in dropsy.

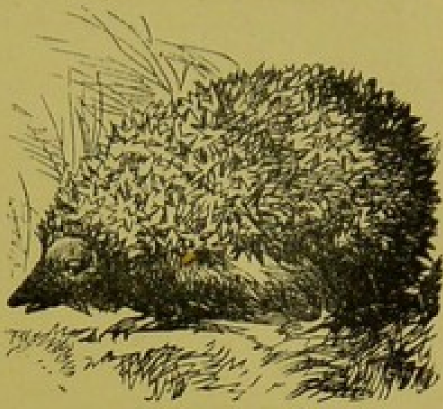
HEPATITIS, *hep-a-ti'-tis* (Gr. *hepar*, the liver), a term applied to inflammation of the liver. In temperate latitudes hepatitis is a rare disease; but in tropical climates it is often so acute, sudden, and fatal, as to defy medical treatment. The principal indications of the disease are, pain in the right side and shoulder, tenderness in the right hypochondrium when pressed, together with enlargement of the liver, often vomiting, always fever, with loss of appetite and a foul tongue. It is frequently accompanied by



HIPPOCAMPUS.



HORNBILL.



HEDGEHOG.

HARPY EAGLE.

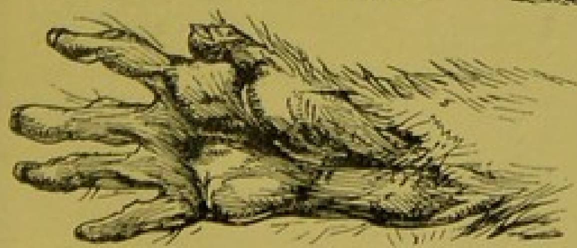
HOP.

HARTE BEEST.

HELLEBORE, GREEN.

HAREBELL.

HOUSE-LEEK.



HAND, MONKEY'S.

HAND, HUMAN.

jaundice. Hepatitis sometimes terminates in abscesses, which, on some occasions, require to be opened externally. After the disease has been subdued, vegetable tonics are useful in restoring the digestive powers.

HEPTAGON, *hep'-ta-gon* (Gr. *hepta*, seven, and *gonia*, angle).—A plane figure composed of seven sides.

HEPTANDROUS, *hept-an'-drus.*—A term which signifies a plant having seven stamens.

HERBS, OR HERBACEOUS PLANTS, *herbz, her-bai'-se-us* (Lat., *herba*).—Plants which have stems that die down annually to the surface of the ground.

HERCULES, *her'-ku-leez*, a constellation in the northern hemisphere. It contains no stars of the first and second magnitude.

HERCULES BEETLE.—A very large beetle (*Scarabæias Hercules*), about five inches in length, a native of Brazil. The male insect has a large horn projecting from the head, and a similar, but smaller projection, from the thorax, the two resembling a pair of pincers.

HERMAPHRODITE FLOWERS, *her-maf'-fro-dite* (Gr., *hermaphroditos*).—Those which possess both stamens and pistils, the male and female organs of reproduction. They are known as "perfect" flowers.

HERMAPHRODITISM.—The union in the same individual of the sexual characteristics of the male and female. It occurs sometimes as a monstrosity, in the higher vertebrata; but is normal in some of the lower organisms.

HERMIT CRAB. (*See* CRAB.)

HERNIA, *her'-ne-a* (Gr., *hernos*, a branch, from its protruding forwards). In Anatomy, the protrusion of any viscus from its natural cavity. In a more restricted sense, however, the word only signifies a protrusion of the abdominal viscera. Hernia, in the latter form, is unfortunately very frequent. Men are much more liable to hernia than women, the proportion being about four to one; and the liability to the disease increases with years. A hernia is always composed of a "sac" and its contents. The former is a portion of the peritoneum pushed forward by the protruding viscera, and forming a pouch. The contents of the sac vary greatly; but generally consist of a portion of the small intestine, especially the *ileum*. A certain quantity of fluid is always found secreted in the sac together with the viscera. The principal divisions of the ordinary disease are—reducible (when it is returnable into the abdomen), irreducible, and strangulated hernia. Reducible hernia is treated either with a truss, so as to retain the protrusion within the cavity of the abdomen, or the treatment may be radical, the contrivances for which are purely surgical. The protruded viscus cannot be returned into the abdomen in irreducible hernia. If the intestines cannot be returned by pressure, and are so tightly constricted that the circulation is inerted, it is strangulated hernia, by far the most dangerous form, as the strangulated part may become gangrenous, chloroform is administered internally, so as to relax the muscle, or a hot bath, or bleeding to the verge of faintness. If none of these methods are of any avail, the operator is obliged to divide the constriction by means of the knife.

HERON, *her'-on* (Fr., *ardea*).—A family of birds, of which the common heron (*Ardea cinerea*) is the general type, belonging to the class *Grallatores*. The common heron is one of the most numerous, as well as the best known of wading birds, and formerly the bird was considered royal game, and statutes were passed for its preservation. The heron is said to be very long-lived, and was formerly held in considerable estimation as an article of food. It visits most parts of the United Kingdom, and occupies the heronries, which are built for its comfort, from spring until the month of August. It visits Scandinavia in summer, going occasionally as far north as the Faroe islands, Iceland, and the southern coast of Greenland; but it is most abundant in Holland. The plumage is usually of a bluish-ashy colour, and the average length of the bird from the point of the beak to the end of the tail about three feet, while from the carpal joint to the end of the wing, the extent is about seventeen inches. The solitary habits of the heron are well known, for, except during the breeding season, when they congregate in large flocks, they are generally seen alone. Their food is nearly entirely composed of fish, and they will be seen standing for hours by the side of ponds and streamlets, watching for their prey, which they catch by a single dart of their powerful beak. Besides the common heron, there are the Purple heron, which is found in the temperate parts of Europe, in Africa, and in Asia; the Great White heron (or great egret), an accidental visitor to this country, but common in the eastern parts of the Mediterranean; the Buff-backed heron, and the Squacco heron, a native of Egypt.

HERO'S FOUNTAIN. (*See* HYDRAULICS).

HERPES, *her'-pees* (Gr., *herpo*, I creep).—A disease of the skin, made by vesicles occurring in clusters. There are several varieties, but they are not dangerous, and the smarting and itching are easily relieved by soothing external applications.

HERPETOLOGY, *her-pe-tol'-o-je* (Gr., *herpeton*, a reptile; *logos*, a discourse), a term applied to that portion of Natural History which treats of reptiles.

HERRING, *her'-ring* (Ger., *heer*, an army, on account of the great numbers in which they visit our shores), belongs to the family of the *Clupeidæ*, a branch of the order termed *Malacopterygii*, on account of their being possessed of a scaly body like the salmon, no adipose dorsal fin, and by the upper jaw being formed in the middle by the intermaxillary, and on the sides by the maxillary bones. The upper part of the fish is a fine blue colour, with green and other reflections, when viewed in different lights; the lower part of the side and belly, and the gill-covers, silvery-white. The herring is a constant visitor to our shores, where it continues some months. It is a very prolific fish, and immense numbers are frequently taken by one haul of the net. Cured by various processes, and known as kippered herrings or bloaters, herrings are among the best known additions to the breakfast table.

HESPERIDIUM, *hes-pe-rid'-e-um.*—A kind of fruit, examples of which are afforded by the orange, lemon, lime, and shaddock. The seeds are imbedded in the pulp, and attached to the inner angle of each of the divisions into which the fruit is divided.

HESSIAN FLY, *hes'-shun.* (*See* CECIDOMYIA.)

HETEROLOGOUS SERIES, *het-er-ol'-o-gus* (Greek, *heteros*, various).—In Chemistry, heterologous series are those whose members manifest a similarity of origin from homologues, but which differ considerably in their properties. (*See* HOMOLOGOUS SERIES.)

HETEROCERCAL, *het-er-o-ser'-kal* (Gr., *heteros*, and *kerkos*, a tail).—A peculiarity of structure in some fishes, the tail being insymmetrical by the prolongation of the vertebral column into the upper lobe of the tail, which is much longer than the other. It is a characteristic of the cartilaginous fishes, and appears in fossils in the older geological formation. The term was introduced by Agassiz.

HEXAGON, *hex'-a-gon* (Greek, *hex*, six, and *gonia*, angle).—A figure of six sides, a *regular* hexagon being that of which the sides are equal. It is one of the three figures a number of which can be fitted together without any intervening spaces, and of these it has the greatest area. The honeycombs of bees are hexagonal, and consequently enclose the greatest space with the least expenditure of wax.

HEXAHEDRON, *hex-a-he'-dron* (Greek, *hex*, and *hedra*, base).—A solid with six faces, as the cube. (*See* CUBE.)

HEXYL, *heks'-il*. (*See* CAPROYL.)

HIATUS, *hi-ai'-tus* (Lat., a yawn, gap, or chasm), a deficiency in the text of an author, from a passage erased. In Grammar and Prosody, it signifies the occurrence of a final vowel, followed immediately by the initial vowel of another word.

HIBERNATION, *hi-ber-nai'-shun* (Latin, *hibernare*, to pass the winter).—Some members of the animal kingdom, chiefly rodentia and chiroptera, sleep during the colder months of the year. The habit of hibernation of hedgehogs, bats, and dormice are well known. All hibernating animals secure themselves as far as they can from disturbance during the period of sleep by selecting obscure places, as caves or holes in the ground. Some make solitary nests, others congregate in large numbers. Hedgehogs and dormice roll themselves into balls, bats group into clusters hanging head downwards. There is scarcely any evidence of respiration, but there is muscular imitation. The loss of weight amounts sometimes to nearly 40 per cent. In most cases there is a considerable accumulation of fat before hibernation commences, and that supplies the small amount of vital heat required. In northern climates, the bear sleeps during the winter. (*See* BEAR.) No hibernating birds are natives of the British islands.

HIBISCUS, *hi-bis'-kus* (Gr., *hubris*, haughtiness).—A genus of the natural order *Malvaceæ*. There are many species, mostly natives of warm climates. Some are trees or shrubs, but most of them annual or perennial herbaceous plants. The species *H. cannabinus* yields the fibre known as *sunnee*, or *brown Indian hemp*, which is used in India as a substitute for true hemp. *H. arboreus*, a native of the West Indies, is also remarkable for the tenacity of its inner bark. The petals of a Chinese species, *H. rosasinensis*, are astringent, and are used also to blacken eyebrows and the leather of shoes. The seeds of *H. Abelmoschus*, or "musk seed," are mixed with coffee in Egypt and Arabia, and also used by perfumers. Various other species of *Hibiscus* yield valuable fibres useful for textile fabrics, or for paper.

HICCUP, OR HICCOUGH, *hik'-kup*, *hik'-kauf*.—A short convulsive inspiration, generally repeated at intervals of a few seconds, arising from a spasmodic contraction of the diaphragm, which affects the glottis and occasions the well-known sound. The paroxysm seldom lasts more than a few minutes. The cause is generally to be found in gastric derangement. A slight attack may often be put an end to by taking a full inspiration and then holding the breath as long as possible, and pressure round the waist frequently affords relief.

HICKORY. (*See* CARYA.)

HIERACIUM, *hi-e-rai'-se-um*. (*See* HAWKWEEDS.)

HIGH WATER is defined to be the utmost flow and greatest elevation of waters acted on by tidal influence, and it is also a term applied to the time of such elevation. The time of high water depends on the age of the moon, and is nearly always the same at the same place at the full of the moon. High water lasts about fifteen to twenty minutes, after which time the tide begins to ebb. The method by which the time is found is as follows:—Add four-fifths of the days of the moon's age, considering them as hours, to the time of high water at the full of the moon, and the sum thus obtained will be found to be the time of high water answering to the day in question. *High-water mark* is, theoretically, the line made on the shore by the tide at its utmost height; but the Trinity House high-water mark showing the ordinary line is occasionally exceeded when the tide is unusually high. (*See* TIDAL ACTION.)

HINNY. (*See* MULE.)

HIP, OR HEP.—The fruit of the rose, consisting of the enlarged fleshy tube of the calyx filled with hard seed-like substances, surrounded with bristly hair. The fleshy part, conserved with sugar, is used in medicine, and known as conserve of hip; and in some parts of Europe, hips preserved in sugar are an article of food.

HIP-JOINT.—In Anatomy, the globular head of the thigh bone is received into a deep cavity, forming a ball-and-socket joint, allowing extraordinary freedom of movement, and it is greatly strengthened by a large number of surrounding muscles, some of which are of great power. Disease of the hip-joint often involves very serious consequences. In most instances it results from a scrofulous condition, and almost always occurs in childhood. It can sometimes be traced to over-exertion or a strain, but in many cases no apparent cause can be assigned. Abscesses form around the inflamed joint, and in many cases communicate with the interior, and the head and neck of the thigh bone become softened and disintegrated, and are drawn out of the cavity by the action of the surrounding muscles, so forming the ground of a fungoid mass at the bottom of the cavity. This is ordinarily followed by shortening of the limb. In some instances the disease will be in progress for nine or ten years.

HIPPOCAMPUS, *hip-po-kam'-pus* (Gr., *hippos*, horse; *kampto*, I bend.—A genus of lophobranchiate fish, belonging to the family of the *Syngnathidæ* known in England by the appelation of the Sea-horse or Pipe-fish. The length of the *hippocampus*, from the point of the nose to the end of the tail, is generally about five inches; the form of the body heptangular, covered with scales, and the number of segments into which it is divided about thirty. Its general colour is a pale ash-brown, relieved by a changeable iridescence; and variable tints of blue are dispersed over different parts of the head, body, and tail. The shape of the head bears a grotesque resemblance to that of a horse, whence the name. When swimming about, it maintains a vertical position; but the tail is ready to grasp whatever meets it in the water, quickly entwines in any direction round the weeds, and, when fixed, the animal intently watches the surrounding objects, and darts at its prey with great dexterity.

HIPPOCRATEACEÆ, *hip-po-krai'-te-ai'-se-e.*—The *Hippocratea* family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*—shrubs with opposite simple leaves and small deciduous stipules. Flowers small, regular, and unsymmetrical. The plants of this order abound principally in South America; some are found in Africa and the East Indies. Some have edible fruits, as the species of *Tontalea*, found in Brazil and Sierra Leone. *Hippocratea comosa* yields oily and sweet nuts.

HIPPOMANE, *hip-pom'-a-ne*, a genus of the natural order *Euphorbiaceæ*. The species *H. mancinella* is the famous manchineel-tree, which is asserted to be so poisonous that persons have died from merely sleeping in its shade. It flourishes in the Antilles and on the American continent, near the sea, and forms a very handsome tree, with foliage not unlike that of the pear-tree. The juice which fills the tree is of a pure white colour, and when dropped on the hand, it burns like fire, forming an ulcer very difficult to heal. The fruit, which resembles a very beautiful apple in appearance, contains a similar juice, but of a milder character. The timber is beautifully variegated, and susceptible of a high polish. It takes its name from the Gr., *hippos*, a horse; *manomai*, I rage.

HIPPOPOTAMUS, *hip-po-pot'-a-mus* (derived from the Gr., *hippos*, the horse; *potamios*, of the river).—A pachydermatous animal, which inhabits most of the rivers of Africa. The skeleton of the hippopotamus approaches that of the ox and of the hog; but it presents also wide differences, which separate it from classification with any other animal. The hippopotami live during the day time immersed in the waters of their native rivers, and at night come to land for the purpose of feeding. It is a gregarious animal and the damage done by a herd in search of food is so great that the animals are destroyed when possible by the cultivators on the banks of the rivers. It is taken in pitfalls, or harpooned, or shot. The flesh, especially the feet, is much liked by the natives of South Africa, and, salted, is a substitute for bacon with some of the settlers. The tongue and jelly made from the feet are considered to be delicacies. The hide is used for many purposes, especially for the thick soles of boots, and the huge teeth are very valuable as ivory. From their being able to breathe under water they appear to be posssessed of some muscular arrangement for closing the nostrils, as is seen in seals and other marine animals. The hippopotamus is generally inoffensive if undisturbed, but is likely to be very dangerous when pursued. It can be tamed and becomes much attached to its keeper. One exhibited in London about twenty years ago permitted the attendant to put his head into its mouth.

Fossils.—Remains of different species of hippopotami, are often found in the tertiary geological formations of Europe; and in the tertiary stratas at the foot of the Himalaya mountains, in Hindostan, an extinct species of hippopotamus has been discovered. Boehart identifies the hippopotamus with the *Behemoth* mentioned in Scripture; but Cuvier, while agreeing with him that the identity is possible, still asserts that the description given in the book of Job is not sufficient to place the matter beyond doubt. That it was known to the ancients is conclusive from the fact that Herodotus, Aristotle, Pliny, and Diodorus, each and all give descriptions of the animal The specimens of the hippopotami in the gardens belonging to the Royal Zoological Society in Regent's Park consume daily upwards of 100 lb. weight of hay, chaff, corn, roots, and other green food.

HIPPURIS, *hip-pu'-ris*, the Mare's-tail, a genus of the natural order *Haloragaceæ*. *H. vulgaris* is an insignificant plant, common in stagnant water and slow streams.

HIPPURITES.—A genus of fossil plants of the coal-measures are called Hippurites from their close resemblance to the *Hippuris vulgaris*. If they grew in the same relative proportions as the existing plant, many of the fragments found would indicate a height of 18 or 20 feet.

HIPPURITE, *hip'-pu-rite* (Gr., *hippos*, horse), in Geology, a massive horsehoof-like bivalve of the chalk formation, having a deep conical or sub-cylindrical under-valve, with a flattish lid, or upper valve. The anomalous form of the fossil has been a great cause of perplexity to geologists as to classification. Sixteen species are known.

HIRUDO. (*See* LEECH.)

HIRUNDO, *hir-un'-do* (Lat., a swallow), a genus which forms the type of the fissirostral or wide-gaping birds. (*See* SWALLOW.)

HISTOLOGY, *his-tol'-o-je* (Gr., *histos*, a web; *logos*, a discourse).—A term identical, or almost so, with general minute anatomy, or microscopic anatomy. Histology classifies and describes the structural or morphological elements which exist in the solid and fluid parts of organic bodies.

HOAZIN, *ho-a'-zin.*—A bird, known also as the Touraca (*Opisthocomus cristatus*), nearly as large as, and in some degree resembling, the peacock. It is a native of Guiana and Brazil. It is generally classed with the family *Cracidæ*, and the gallinaceous order.

HOAR FROST. (*See* FREEZING.)

HOARSENESS. (*See* THROAT.)

HOBBY, *hob'-by.*—A small species of falcon (*Falco-subbuteo*), about 12 inches in length, of a dark-grey colour on the upper parts, the feathers being edged with yellowish white. It is a native of most parts of Europe, Asia, and Africa. In Britain it is rare.

HOG, OR HOG FAMILY, *hog* (Welsh, *hwch*; Cornish, *hoch*), a family (*Scridæ*) of pachydermatous animals, belonging to the order *Ungulata*, of mammalia; or forming, according to some arrangements, a sub-family of the *Elephan-*

tidæ, under the title *Suina*. The *Suidæ* are distinguished by having the nose prolonged and cartilaginous, truncate at the tip, where it is strengthened by small button-shaped bones, by by which means they are enabled to use their noses as grubbers to turn up the ground in search of food. With the exception of the genus *Dicotyles* (*see* PECCARY), they have four toes on each foot, two large principal ones shod with stout hoofs, and two lateral ones, which are much shorter, and barely touch the ground. The canine teeth are large, often projecting from the mouth, and curved in an upward direction, while the molars are tubercular. Their skin is covered with thick, strong bristles, and they have a distinct tail of moderate length. The genus *Sus* is the type of the family *Suidæ*, and contains two well-known varieties—the wild boar and the domestic pig. Although formerly very common, the wild boar no longer exists in Great Britain; it is now found principally in India, and in most parts of Europe, where it harbours in the most solitary places in retired forests. As a beast of chase, it is thought well worthy of attention by sportsmen. In its domestic state the hog feeds and thrives on nearly every kind of food, both vegetable and animal; and no other species of beast converts a given quantity of corn or other nutritive food into fat so soon, or can be made fat on so great a variety of food. Of this useful animal there are many varieties. The Chinese variety is very short in the head, corpulent in the body, and short in the legs: although good for roasting when about three weeks old, they only make tolerable porkers, and are not of much service in making bacon, as their size is but small. The Neapolitan hog is black and very plump, with erect ears and without any hair, and forms a very good cross with the Berkshire hog. The hog is very prolific, the sow often having ten or twelve pigs at a litter, and two litters in the year. Its flesh, under the name of *pork*, constitutes a material part of the food of mankind, especially in Europe and America. The Jews and Mahommedans abstain from the flesh of the swine, and even consider themselves defiled by touching it. Pork takes salt better than any other flesh, and is consequently able to be longer preserved. The fat is called *lard*, and is used both for culinary and medicinal purposes. The skin, when dried, is used for making the seats of saddles, and other purposes. The bristles are used by brushmakers, shoemakers, and other artificers; and a great quantity is imported of the same from Russia; those from Ukraine being held in the highest estimation. (*See* BACON and HAM.) The Abyssinian hog (*Babirussa Alfurus*), an inhabitant of the islands of the Indian Archipelago, differs from the common hog, or *sus*, in consequence of the upper canine teeth being enormously developed, ascending upwards and curving back, while those of the lower jaw project straight outwards, and form long slender hooks. The Ethiopian hog (*Phacochærus Æthiopicus*) is another variety; its only great distinction is the possession of a pair of lobes under the eyes, which give it a peculiar appearance. It inhabits Central Africa, and its flesh is esteemed a great dainty. A species exhibits some peculiarities (*S. Papuensis*), is a native of New Guinea, and its flesh is said to be very delicate. Fossil remains of most of the members of the hog family have been found in tertiary formations, three alone of the species being found in the Epplesheim Sands, while their bones have been discovered in nearly every country.

Hog-Gum. (*See* RHUS.)

Hog-Nut. (*See* CARYA.)

Hog-Plums. (*See* SPONDIAS.)

Hog-Rat. (*See* HUTIA.)

HOLIGARNA, *ho-le-gar'-na.*—A genus of the natural order *Anacardiaceæ*. The fruits of this species *H. longifolia*, with those of another plant of the same order, furnish the black varnish of Sylhet, which is much used in India for lacquer-work. (*See* SEMICARPUS.)

HOLLY. (*See* ILEX.)

HOLLYHOCK, *hol-le-hok'.*—A plant (*Althæa rosea*) of the natural order *Malvacea*, and belonging to the same genus with the marshmallow. It is a native of India and the south of Europe, but has been long cultivated as an ornamental garden plant in this country. It flowers in autumn, and is biennial or perennial. The leaves yield a fine blue dye.

HOLOPTYCHIUS, *ho-lop-ti'-ke-us* (Gr., *holos*, entire; *ptuche*, wrinkle—literally, "all-wrinkle").—A genus of fossil sauroid fishes, belonging to the Devonian and Carboniferous periods. Their enamelled scales have corrugated or wrinkled surfaces, and this character suggested the generic name. They must have been of great size—from 8 to 10, or even 12 feet in length. They were armed with numerous sharp-pointed fish-teeth, and also with larger reptilian teeth of conical form, placed at intervals in either jaw, evidently for the purpose of seizing and cutting up their prey.

HOLOTHURIA, *hol-o-thu'-re-a.*—A genus of *Echinodermata* (which *see*) without the covering of calcareous flakes characteristic of other members of the class. Some are almost globular in shape, and others worm-like and possessing a remarkable power of extension. The largest European species (*H. frondasa*) is about a foot in length when unextended. All the species have the power of reproducing parts. (*See* TREPARG.)

HOLY GRASS.—A grass (*Hierochloe borealis*), found in the north of Europe. It has a sweet smell, and in some countries is strewed on the floors of places of worship on festival days, the popular name being taken from that custom.

HOMALIACEÆ, *ho-ma-le-ai'-se-e*, the *Homalium* family, a natural order of *Dicotyledones*, sub-class *Calyciflorœ*, comprising eight genera and thirty species, trees and shrubs, natives of the tropical parts of India, Africa, and America. Some species of the typical genus *Homalium* are remarkable for their astringent properties.

HOMALOPTERA, *ho-ma-lop'-te-ra* (Gr., level-winged).—A small order of insects generally considered as a division of Diptera. (*See* DIPTERA.)

HOMELYN, *hom'-e-lin.*—A fish (*Raia maculata*), a species of Ray, well known in the London market, and known as the sand, or the spotted ray.

HOME SICKNESS. (*See* NOSTALGIA.)

HOMICIDAL MANIA, *hom-i'-si-dal* (Lat., *homo*, a man; *cædo*, I kill).—An irresistible desire to destroy life is one of the most terrible forms of insanity. It is motiveless, so far as ordinary motives can be taken into account, and is not unfrequently developed in persons who are ordinarily amiable, reasonable, and well conducted. Indeed, the best loved objects are very frequently the victims. Mothers will kill their young children, husbands destroy their wives. In women, physical weakness, or derangement of the system after childbirth, will frequently lead to infanticide. But in other cases, there seems to be a blind instinct of destruction which makes the first person meet with the victim. Sometimes the mania bears an imitative character, as it has frequently been observed that when public attention has been directed to a crime of a peculiarly atrocious character, similar crimes are attempted or perpetrated.

HOMŒOPATHY, *ho-me-op'-a-the* (Gr., *homoios*, like, and *pathos*, state or feeling).—The name given to a system of medical treatment introduced by Samuel Hahnemann, a German physician, in 1796, and now extensively practised, and having many adherents. Hahnemann came to the conclusion that diseases are cured by such substances as produce symptoms similar to them on the healthy body: hence the great doctrine of this sect is, *Similia similibus curantur* (like are cured by like). This general law by no means originated with Hahnemann, but is as old as the time of Hippocrates, by whom it was first propounded. No one, however, previous to Hahnemann, had ever asserted it to be of universal application. Nothing is better suited for restoring circulation to a frozen limb than to rub it with snow; and the best mode of treating a burn is to take out the heat by holding it to the fire, or by applying oil of turpentine. The benefits that arise from vaccination are also owing to the same principle. Another characteristic feature, of this system is the infinitesimally small doses in which their medicines are usually administered. In the case of a medicine where an ordinary medical man would prescribe perhaps a grain, the homœopathist would administer only the millionth part of a grain, or even less. They assert that only very minute doses are fitted to act upon a system already predisposed to their influence by the existence of the disease; and hence the amount of the medicine must be diminished so as to exert its curative power upon the system without aggravating the symptoms of the disorder. This system has been adopted by not a few medical men of distinction, and its adherents are to be found in most parts of the civilized world. Some portion of the success obtained by homœopathic physicians may be due to their attention to the principles of *hygeia*, or the preservation of health by proper diet, temperance, ventilation, and cleanliness. It is certain that the orthodox doctors have, though without acknowledgment, taken a lesson from the reformers; smaller doses of drugs are administered, and they are not so large and nauseous as at one time they almost invariably were.

HOMOGENEOUS BODIES, *ho-mo-je-'ne-ous* (Gr., *homos*, the same; *genos*, kind). Those bodies in which the constituent elements are all similar. In Mathematics, homogeneous quantities are those which can be added to or subtracted from one another.

HOMOLOGOUS SERIES, *ho-mol'-o-gus* (Gr., *homos*, similar; *logos*, proportion).—A series whose numbers differ from each other by a constant increment or decrement of an even number of equivalents of CH. They are generally classed under a generic term, such as the alcohols, hydrocarbons, &c. The following series of homologus will illustrate this:—

Hydrocarbons.		*Alcohols.*	
C_2H_2	Methylene.	$C_2H_4O_2$	Methylic alcohol.
C_4H_4	Ethylene.	$C_4H_6O_2$	Ethylic "
C_6H_6	Tritylene.	$C_6H_8O_2$	Tritylic "
C_8H_8	Tetrylene.	$C_8H_{10}O_2$	Tetrylic "
$C_{10}H_{10}$	Amylene.	$C_{10}H_{12}O_2$	Amylic "

By examination it will be seen that each of the members of these series differs by exactly C_2H_2. The ethers, aldehyds, mercaptans, and many others, form similar homologous series. The corresponding difference in composition produces a corresponding difference in properties.

In Geometry, homologous quantities or magnitudes are such as correspond, or are like to one another, as in similar triangles, those sides which are opposite to corresponding animals are homologous.

HOMOLOGY, *hom-ol'-o-je*.—In Anatomy, structural correspondence of parts in different animals. A homologue is the same organ under every variety of form and function. It is the opposite to anologue, which means a part or organ in one animal which has the same functions as another part or organ in a different animal.

HOMOPTERA, *hom-op'-te-ra* (Gr., *homos*, and *pteron*, a wing).—One of the two great divisions of the order *Hemiptera*, having the first pair of wings of uniform subsistence throughout. Among the best known species are the cicadas, the aphides, and the coccus tribe.

HONESTY, *on-'es-te*.—A genus of plants (*Limaria*) of the order *Cruciferæ*. Two species (*L. annua* and *L. rediviva*), natives of the South of Europe, are cultivated in our gardens on account of the beauty of their flowers, they are from 18 to 24 inches in height, with peculiar seed pouches. The origin of the name is unknown; but formerly extraordinary virtues were ascribed to the plant.

HONEY, *hun'-e* (Sax., *hunig*), a fluid, or semi-fluid substance, very similar in its properties to sugar. It is found in large quantities in a number of vegetables, and is collected by different kinds of bees from the nectiferous glands in the cup or chalice of flowers. Honey, in the ordinary sense of the word, however, cannot be called a purely vegetable production; for, after it is collected by the proboscis of the insect, it is transmitted to the sucking-stomach, or honey-bag, where it is elaborated, and afterwards disgorged, to be deposited in the cell of the honeycomb. When the bees are very young, the honey undergoes less change and remains nearly white; in this state it is called virgin honey. At all times it partakes of the qualities of the plant from which it has been derived. Hence some varieties of honey obtained from the azalea, rhododendron, &c., are poisonous. The most wholesome kinds are derived from the genus *Erica*, called heather honey, and from most labiate plants. Honey differs much in colour and consistence; it contains a considerable quantity of saccharine matter, and some mucilage, from which it derives its softness and viscosity. It ferments very readily, and yields a strong vinous liquor called *mead*. There are two varieties of honey, one yellow, transparent, and of the consistence of turpentine; the other white, and capable of assuming the solid form, and of concreting into regular spheres. These two specimens are often united, and may be separated by means of alcohol, which dissolves the liquid honey much more rapidly than the solid. Honey is produced in most countries. It is principally exported to this country from Greece, France, Portugal, North America, and the West Indies. Honey is much used in making preserves and confectionary; and, in its natural state, to put on bread. It is also used as a demulcent medicine against hoarseness, catarrh, &c.; and externally to promote suppuration. In its clarified state, it is used to sweeten certain medicines. It is more aperient and detergent than sugar, and is particularly serviceable in promoting expectoration in disorders of the breast. For these and other like purposes, it is often mixed with vinegar, and boiled down to a proper consistence over a slow fire, when it forms the oxymel of commerce. Honey was one of the first articles of human nourishment. Some of the ancients believed that it fell from heaven, and even Pliny thought that it was a juice formed by the purification of the air and afterwards collected by bees. It was looked upon as a symbol of abundance; and in the Bible, the Promised Land is described as a land of "milk and honey."

HONEY-DEW.—An exudation of a saccharine character on the leaves and stems of plants, frequently occurring in warm dry weather. It is caused sometimes by the punctures made by aphides and other insects, and sometimes from the rupture of the tissues of the plant. It is the superabundance of sugar thrown off in the production of the sap. If not worked off, moulds and other small fungi, the germs of which are brought by the atmosphere, appear on it; and orange, lemon, and coffee plantations have suffered severely from that result.

HONEY-EATER.—A large family of bats (*Meliphagidæ*), allied to the Sun-birds and Humming-birds. They are peculiar to Australasia. They belong to the order *Insessores* and tribe *Tenuirostres*, have elegant forms and brilliant plumage, very lively and active. The tongue is peculiar, terminating in fine filaments, adapted to sucking honey from flowers and juices from fruits. Insects also are eaten. The tail is generally long and broad. One species (*Meliphogæ*), is known in Australia as the Rifle-bird; and another (*Myzantha melanophrys*) as the Bed-bird, from the tinkling sound it makes. A much larger species is the Tui-tui, or Parson bird of New Zealand, which is larger than a thrush, and of a metallic green colour, with white tufts on the neck. It is a fine songster, imitates the notes of other birds, and can be taught to repeat words.

HONEY GUIDE, OR MOROC, *mo'-rok.* A genus of African birds, having some resemblance to the cuckoos and also to the woodpeckers and creepers. They flutter over travellers and make a peculiar sound as if wishing to attract attention; and it is said, if their flight is followed, they always lead to a bees' nest.

HONEY LOCUST TREE. (*See* LOCUST TREE.)

HONEY-STONE. (*See* MELLITE.)

HONEYSUCKLE, *hun'-e-suckl.*—A genus of plants (*Lonicera*) of the natural order *Caprifoliaceæ*. The common Honeysuckle (*L. periclymenum*) is well-known in Britain, and is often planted in shrubberies and trained against walls on account of its beautiful whorls of cream-coloured flowers, and beautiful fragrance. There are many other species, natives of Europe, Siberia, and North America.

HOODED SNAKE, *hood'-ed*, the *Cobra di capello* (Port., snake with the hood). This term is sometimes applied to the *Naja tripudians* alone, and sometimes to all the species of the genus *Naja*, which are very venomous serpents of the *Viperidæ*. They are all remarkable for the singular manner in which they dilate the back and sides of the neck when irritated or excited. To this faculty they are indebted for their name. The length of this snake is generally three or four feet, of a pale dingy-brown colour above, and bluish or yellowish-white below. It is characterized by a peculiar mark on the back of the neck, which closely resembles a pair of spectacles: for this reason the reptile is frequently called the "spectacle snake." It lives upon lizards and other small animals, and is easily killed, being a sluggish animal. Its bite is extremely venomous, causing death within two hours. The poison is secreted in a large gland in the head; and when the animal closes its mouth on any object, the poison flows into the wound made through a cavity in the tooth. The Indian jugglers tame some of these serpents, and teach them to play tricks and dance, to astonish the people—after having taken care, however, to pull out their poisonous teeth. The same use is made of another species in Egypt.

HOOF.—The horny tissue covering the feet of horses and some other quadrupeds. (*See* HORNY TISSUE and HORSE.)

HOOK-SQUID, *skwid.*—A common name for a cephalopod mollusc allied to the common squid. They are sometimes of great size, reaching six feet in length, and very formidable to bathers. The tentacles are very long and have hooks at the extremities. They are found in the South Pacific, and the Sargasso Sea.

HOOPING-COUGH, *hoop'-ing* (Ang.-Sax.), a cough in which the patient hoops or whoops with a deep inspiration of breath. On account of the violence of the cough attending this disease, the term *pertussis* has been applied to it; and on account of the recurrence of the cough in paroxysms, it is also known by the name of "chin," or "kink" cough. At first it resembles a common cold; but at the end of about one or two weeks, the fits of coughing become more long and frequent; a sensation of tickling in the larynx and trachea accompanies each fit, during which the inspirations are irregular, especially in the case of children. The efforts of coughing become so rapid and violent, as to take away the breath; during the intervals between, it is difficult to perceive any inspiratory movements, excepting at times when the cough is interrupted by a peculiar whooping sound, which has given this disease its common name. In young children, hooping-cough often becomes complicated with other diseases. It prevails as an epidemic disease, and children from birth to the period of second dentition, are chiefly liable to it. Adult persons, however, are not exempt from it, and it sometimes happens in old age. The disease is very contagious, and when it once finds admission into a house, very few young persons, who have not had it previously, escape. It rarely affects the same individual twice, although this sometimes occurs. Hooping-cough is a very fatal malady. It must, necessarily, run a certain course, which often, in spite of skilful treatment, may be long. The administration of emetics in the earliest stages of the disease is often efficacious. In protracted cases, nothing appears to be so effective in putting a stop to the cough as change of air, which frequently succeeds when all other methods have failed.

HOOPOE, *hoop'-o*.—An insessoral bird, *Upupa epops*, belonging to the order *Insessores*, and family *Upupidæ*. The hoopoe is a summer visitor to the British islands, and comes from the north of Africa; it is also a native of Asia. This bird is generally about a foot in length, and its plumage is composed principally of black and white feathers; it is particularly distinguished by a crest on the top of its head, composed of buff feathers, tipped with black.

HOP.—A plant (*Humulus lupulus*), of the natural order *Cannabinaceæ*. The common hop plant has a perennial root and annual pliable stems, which twine from right to left around any convenient support. The male and female flowers are generally on separate plants. The former are in loose panicles; the latter in dense catkins or strobiles, with membranous concave bracts. The hops of commerce consist of the female flowers and seeds of this plant. Their principal consumption is in the manufacture of beer, and they possess three properties which particularly fit them for this use. First, they impart to malt liquors a pleasant bitter aromatic flavour and tonic properties. Second, they give them a peculiar *headiness*, often confounded with alcoholic strength, and thus save the brewer a certain proportion of his malt. Third, by their chemical influence they clarify the liquors and check the tendency to turn sour. Hop-plants grown from root-sets come to perfection in the third year from planting. They spring out of the ground about the end of April, and flower about the end of August. The strobiles are fit to gather from the beginning of September to the middle of October, the time varying according to the sort cultivated and the differences in the seasons. When picked, they are dried by artificial heat, in kilns, and then packed in bags or pockets. Upon the bracts and scales are numerous little yellow shining grains, generally roundish and kidney-shaped. They have been termed *lupulinic glands*, and are believed to be the most active parts of the hops. The acid of hops is sedative and narcotic, and pillows stuffed with hops are sometimes used with success in cases of sleeplessness. The bitter principle is not narcotic, but tonic. The duty on hops, which produced nearly half-a-million annually, was repealed in 1862. Of the cultivated hop there are many varieties; but in the principal English hop counties—Kent, Surrey, and Sussex—only about five varieties are extensively grown.

HOP-FLY. (*See* APHIDÆ.)

HORARY, *hor'-a-re* (Lat., *hora*, an hour), in Astronomy, the arc described by the sun, moon, or any of the planets, in the space of an hour, or the angle which is subtended by that arc is called its horary motion.

HORDEUM, *hor'-de-um* (Lat.), Barley, a genus of the natural order *Gramineæ*. The principal species or varieties of cereal barley in cultivation are practically distinguished by the arrangement of the seeds. The two-rowed forms, which are generally regarded as varieties of the species *H. distichum*, are those ordinarily cultivated in England. The six-rowed barley, *H. hexastichum*, is more grown in Scotland, where it is known as *bere* or *bigg*. The four-rowed is perhaps only a variety of the six-rowed, though it is described as a distinct species, generally under the name of *H. vulgare*. Very various have been the opinions as to the wild species from which the cultivated barley has sprung; but as *H. distichum* is the only kind that has ever been found apparently wild, it is probable that all the varieties in cultivation have been derived from this type. Barley is used dietetically in the manufacture of bread; and in the form of *malt* (which *see*), most extensively in the production of ale, beer, and ardent spirits. It is the common grain in use for the latter purpose in this country. Barley deprived of its husk constitutes *Scotch*, *hulled*, or *pot barley*. When both husk and integuments are removed, and the seeds rounded and polished, they form *pearl barley*, and this, when ground, is called *patent barley*.

HOREHOUND. (*See* MARRUBIUM.)

HORIZON, *hor-i'-zon* (Gr., *horizein*, to bound, limit).—The horizon, in the general acceptation of the word, is the line by which the view of the spectator is bounded, and in which the sea or land and sky appear to meet. When he is on a level plain of great extent, or at sea, the horizon will assume the form of a circle. This is termed the physical or natural horizon. From the spherical form of the earth, the higher the position of the observer, the greater will be the field of view, or the more distant the horizon will appear; thus a man at the masthead of a vessel can see what is invisible to those who are on deck. The *astronomical horizon* theoretically is formed by a plane passing through the centre of the earth at right angles to another passing through the meridian of the spectator, which divides the heavens into two equal parts or hemispheres. Observations on land are frequently taken by the aid of what is termed an artificial horizon, which consists of the level surface of a trough of mercury, which is parallel to the plane of the horizon, and in which the image of the heavenly body is reflected.

HORN, *horn* (Sax.).—The term horn is, in general language, applied to a hard substance growing on the heads of certain animals, and particularly on cloven-footed quadrupeds, usually attaining some length and ending in a point. They serve as weapons of offence and defence to the animals which bear them. In the deer, the horns are solid. (*See* ANTLER.) In the other horn-bearing ruminants, as the ox, sheep, goat, and antelope, the horns are hollow. In England, the substance called horn may be divided into two distinct classes:—First, the branched, bony horns of the stag genus, and the simple, laminated horns of the ox genus and other kindred genera. The other kind of horn, found in the ox, antelope, goat, and sheep, consists of a number of conical sheaths inserted one into another, the innermost resting upon the vascular membrane covering the bony core. The tip is very dense, and the layers of which it is composed are scarcely distinguishable. This kind of horn appears to consist of coagulated albumen; and there is a regular connection between horns, nails, claws, hoofs, scales, hair, feathers, and even skin.

Horny Tissues.—The horns of the ruminants, the epidermis, and the nails, claws, and hoofs, have a complicated cellular structure. The cells are not developed, as the cells of most other organs are, but dry up, and are agglutinated together by an intercellular substance. They all contain a large quantity of sulphur in combination with a substance having affinity with the proteine bodies. Recent researches have proved that every horny tissue contains at least three different kinds of substances—the cell-membranes, difficult of solution in alkalies, and forming the chief part of the tissue; the cell contents, which dissolve readily in alkalies; and a connecting intercellular substance.

HORNBEAM. (*See* CARPINUS.)

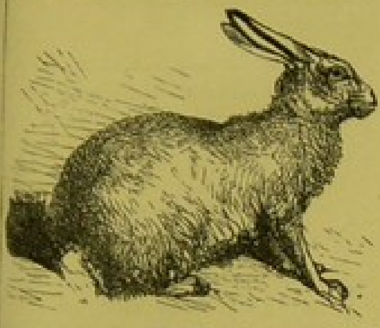
HORNBILL, *horn'-bill* (*Buceros*, from Gr., *bous*, an ox, and *keras*, a horn), a genus of birds belonging to the conirostral tribe of the order *Passeres*. These birds are characterised by having their large hooked beak surmounted at the base by a horny appendage nearly as big as the beak itself, and of a cellular structure within. They live on animals and vegetables, and inhabit the warmest parts of Asia and Africa. The rhinoceros hornbill (*Buceros rhinoceros*) is about the size of a turkey, and of a bluish-black colour. The horny appendage at the base of the bill of this variety is very large, and in the form of a reverted horn. It is a native of Java, and hops about on both legs like a raven, feeding chiefly on rats and mice. The African species (*Buceros Africanus*) is considered a sacred bird by the negroes. The pied hornbill (*Buceros monoceros*) is about the size of a raven, and nearly as black. From its fondness for the same insects, this species is carefully reared in Ceylon, in order to keep the houses clear of vermin. The undulated hornbill (*Buceros undulatus*) is the last variety, and the most beautiful specimen of the whole genus, as the bill is more proportionate to the size of the bird, and its plumage is distinguished by more than the usual vivid colours, which add to the magnificent appearance of Oriental birds.

HORNBLENDE, *horn'-blend* (Ger.), a mixture of the silicate and aluminate of magnesia, lime, protoxide of iron, with a variable quantity of the fluorides of calcium and potassium. It occurs in dark green or black crystals, in syenite, porphyry, basalt, and lava. It is also known as amphibole. *Asbestos* and *amianthus* consist of a fibrous variety of hornblende.

HORNET, *hor'-net* (Sax., *hyrnete*), a hymenopterous insect (*Vespa crabro*) belonging to the *Vespidæ*, or Wasp family. The principal characteristic of the insect is taken from the structure of its wings; these, when it is at rest, are folded throughout their entire length. The hornet is a much larger insect than the wasp, and is consequently much more formidable. It builds its nest in holes in the trunks of trees, or in old walls and ditches. The nest is smaller than those of the wasps, and is of a globular form, constructed with the mouths of the cells downwards. The sting is very severe, and is often productive of serious consequences.

HOROLOGIUM, *hor-o-lo'-je-um* (Latin, *horologium*, a clock, timepiece), a constellation of the southern hemisphere, between Canopus and Eridanus, and formed entirely of stars of the fifth and sixth magnitudes.

HORSE, *horse* (Ang.-Sax.), (Lat., *equus*).—An animal belonging to the family *Equidæ*, a branch of quadrupeds distinguished by a single digit and hoof on each foot. Although, however, the *Equidæ* possess but one developed toe, there are on each side of the metacarpus and metatarsus joints, two small rudimentary processes which represent lateral toes. Of the three great divisions into which the *Equidæ* are separated—namely, the horse, the ass, and the zebra—the former is the largest, the most docile, the most valuable, and, finally, more fully distributed over the surface of the globe, than any of the others. That the horse existed in very remote ages, the researches of geologists afford the most satisfactory evidence; for there is not a portion of Europe, Asia, Africa, or America, in which the fossil remains of this animal have not been discovered, mingled with the bones of the elephant, the hippopotamus, and the deer, as well as the mastodon and other animals which have passed away from the surface of the earth. In most cases these fossils agree with the size of the horse which exists in the present day; but in South America the bones of horses of gigantic size have been exhumed. Recently, in America, the fossilized bones of a small animal have been found, and some geologists are of opinion that it is the original of the modern animal. The canine teeth are wanting in mares. The sense of touch, in general, is extremely delicate; the tongue soft; the upper lip capable of elongation and considerable mobility; and the senses of taste and hearing well developed and very acute. The eyes are large and the sight good; while the sense of smell is so particularly fine, that horses which run in a wild state are said to be able to scent their enemies at the distance of more than a league. The skin is generally covered with a coat of short hair, smooth in summer, and becomming rough and much more elongated during the winter season. The best of the wild Asiatic horses are those which inhabit Tscherkessi, Abassi, and the northern slopes of the mountains of the Caucasus. The wild horses are generally of a pale or greyish-brown colour with brown mane and tail, and a whitish muzzle, which subsides into a black colour about the mouth. They are less in size than the domestic horse, and have a larger head, larger ears, hoofs more contracted and the mane more erect, whilst the tail is much shorter. They do not wander beyond the 50th degree of north latitude. They generally move about in droves, headed by a large grey or black stallion, who constitutes himself the leader. On the Pampas of South America wild horses are exceedingly abundant. The horse is naturally an herbiverous animal, as his thin muscular lips, with his compressed mouth and sharp incisor teeth, are well fitted for seizing and cropping various species of grass. In a domesticated state, however, he is obliged to eat other and harder food, as oats and corn; and for this a provision is made by nature, which supplies him with a peculiar adaptation of the bones of the face, by means of which the horse can comminute and grind down his food better than carnivorous animals. As the teeth of the horse indicate his age, as well as being distinguished for their adaptation for masticating purposes, it will be necessary to give them some slight consideration. The colt is generally dropped with the first and second molar and grinding teeth apparent. When eight days old, the two incisor teeth (central) come out, and in the next five or six weeks he has the two next incisor teeth supplied. In three months' time these teeth will all be uniform, and a third grinder appears; and, after the colt has attained his eighth month, the third nipper above and below, on each side, will appear, and the colt



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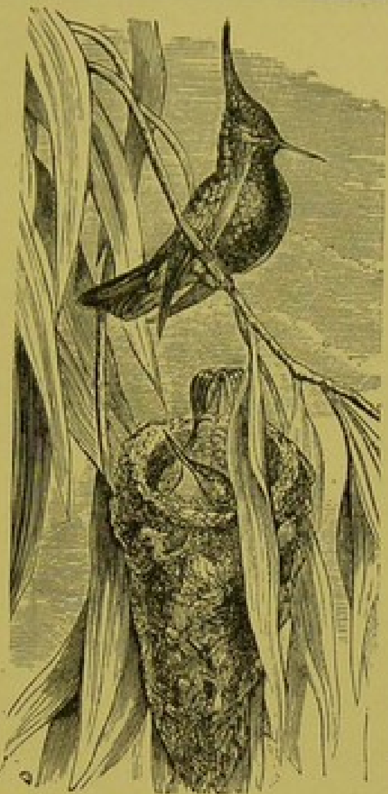
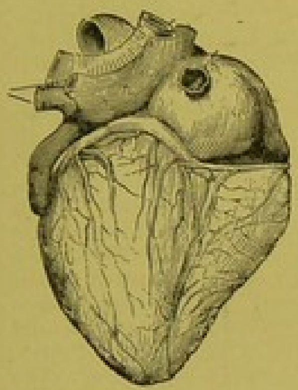


HUMMING BIRDS.

SPOTTED HYENA.



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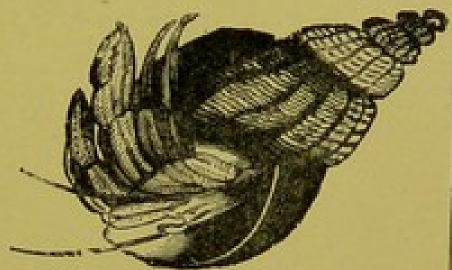

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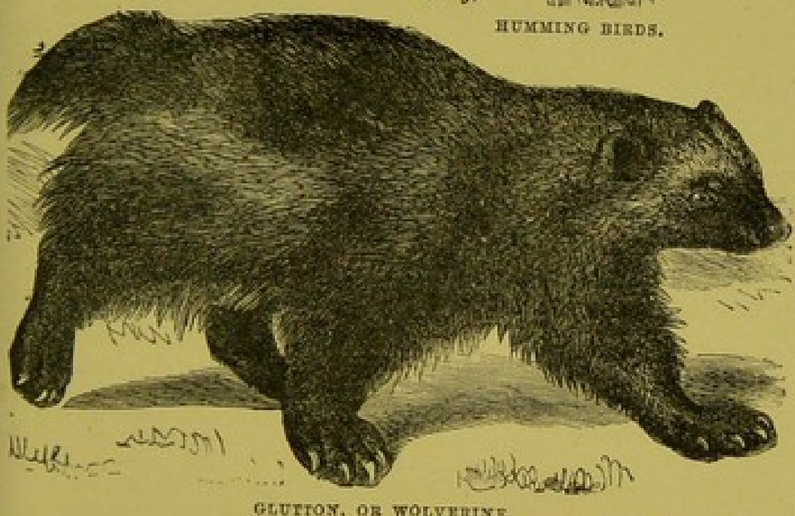
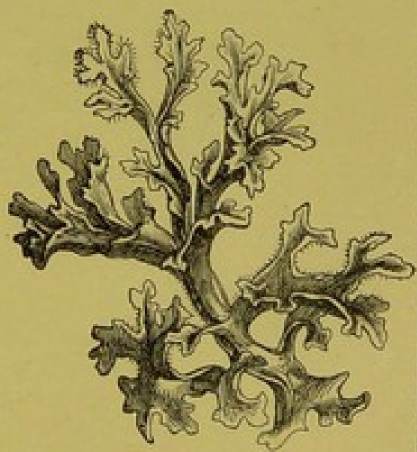


GLUTTON, OR WOLVERINE.



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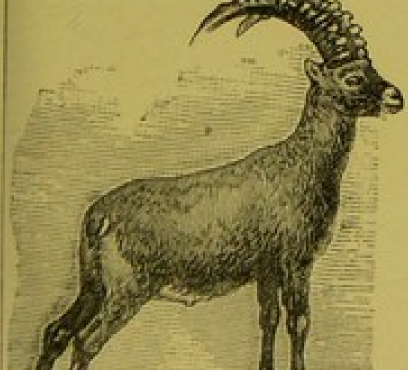

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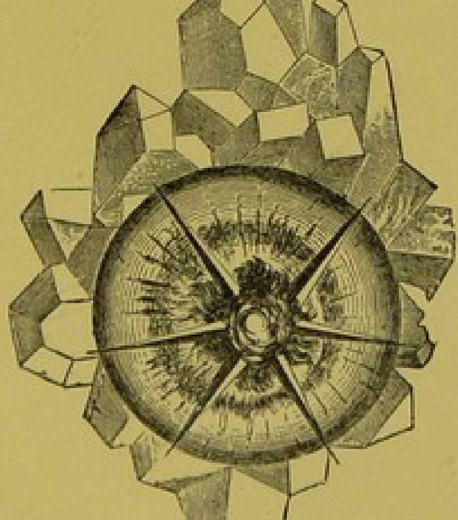


ICE CRYSTAL.

HEATH (ERICA).

will be found furnished with his full complement of front teeth. These teeth are provided with an elevated cutting edge of enamel, and this edge is bent inwards and over the tooth, so as to produce a sort of cavity or depression behind it, which constitutes *the mark*: it is gradually worn down by chipping the grass, and is at length totally obliterated. By the degree in which this mark is effaced, we are enabled to judge of the age of the animal. It may also be added that the deciduous teeth are lost in the order of their acquisition; the two middle incisors of both the upper and lower jaws being displaced between the second and third years. A three-year-old colt has the permanent middle incisors above the gum, but not on a level with the adjoining deciduous incisors; these are also characterized by a large deep groove containing a black substance crossing transversely the working edge of the corner of the tooth, and the sixth grinder is also coming into place. At four years the sixth grinder is on a level with the others, the third deciduous grinder is shed, and the mark is fainter. At six years the fissure on the middle incisors is worn away, but a discolouration still exists; at seven years the mark is worn away from the four middle incisors in both jaws; and at eight years the mark will be found gone from all the lower incisors, and ceases to afford any indication of the age of the animal. It may be added, that these marks are sooner worn away in a stall-fed horse (in consequence of its eating more oats and harder substances) than in one at grass. The mare goes with young upwards of eleven months, and foals standing. The age to which horses would reach, if untouched by disease, is not correctly known; many have exceeded thirty and even forty years, but the majority arrive at their end before they have attained their ninth or tenth year.

Breeds of Horses.—The first change which domestication makes in this animal is in increasing the bulk of his trunk in comparison with his head and limbs; and of all varieties this change is more observed in the *Arabian* than any other. The Arabian horse generally stands in height 14 hands 2 inches. The *Barb* is another variety of the horse, and is smaller than the Arabian, which, however, it eclipses in general excellence, although it has not the Arabian's unflagging speed and spirit. The *Persian* horse is larger than the last-mentioned variety, and is more adapted for warlike purposes than for speed and endurance. The *East-Indian* horse is from 14 to 15 hands high, and is remarkable for a want of bone below the knee, and a fulness of the hocks, which places it far below the Arabian in the scale of excellence. The *Burman* horse is very small, but spirited and strong: he is generally about twelve hands high. The *Tartar* horse is of moderate size, but full of spirit, and very bold, active, and muscular. The flesh of this horse is a frequent article of food amongst the Tartars, who also regularly employ the milk of their mares for domestic purposes. The *Spanish* horse used to resemble the Arabian considerably, in consequence of an admixture of the blood; but the breed has now deteriorated considerably. The *Flemish* horse is a large muscular animal, strongly and beautifully formed. We are indebted to it for some of the best blood of our draught horses, and we have still frequent recourse to it for keeping up and improving the breed. The *English* horse, in the perfection of its different varieties, eclipses those of all other countries.

HORSE-CHESTNUT, *tchest'-nut.*—A genus of trees (*Æsculus*), of the *Sapodiaceæ*, or Sapwort order. The typical species (*A. hippocastanum*), the common horse-chestnut is a very handsome tree, when in flower, the most beautiful, perhaps, of all the large trees cultivated in this country. The erect racemes of beautiful red and white flowers are very attractive in appearance and an avenue of these trees (such as that in Bushey Park) in May, the season for flowering, presents a splendid picture. The tree equals the elm in height, and the branches extend very widely. The timber is used for turnery and fuel, and the bark contains a peculiar bitter and astringent principle, *æsculenc*, which is sometimes used in medicine as a febrifuge. There is a colouring matter in the rind of the seeds and in the husks, which is of some value for dyeing purposes. The seeds, very bitter to the taste, contain a considerable quantity of starch, prepared for food in France, and reputed to be nutritious; an oil said to be a remarkable remedy for rheumatism, and a saponaceous substance which, when reduced to powder, may be used for washing. Chestnuts are liked as food by horses, cattle, and pigs. The tree is supposed to be a native of Persia, and was introduced into Europe about three hundred years ago.

HORSE-FLY.—An insect (*Hippoboica equina*) of the order Diptera (which *see*) known also as forest-fly. It is about half an inch in length, with two long wings, of a brown colour, varied with pale yellow. The mouth resembles that of a flea, and its skin is so hard that it cannot be killed by ordinary pressure. The eggs, black and bead-like in shape, are deposited one at a time. The fly greatly annoys horses, whence the name.

HORSERADISH.—A genus of plants (*Armoraciæ*) of the natural order *Cruciferæ*. It grows in damp meadows, and is cultivated for the sake of its roots, which are scraped or grated down and used chiefly as an accompaniment to roast beef. It is also used as a medicine or a stimulant.

Horseradish Tree.—A tree (*Moringa pterygo-sperma*), the roots of which resemble those of the common horseradish and are similarly used. The leaves also are used in curries and with vinegar. It is a native of India and Arabia.

HOTTONIA, *hot-to'-ne-a.*—A genus of plants of the natural order *Paimulaceæ*. One species, the Water Violet, or Featherfoil (*H. pelustris*), is a very beautiful aquatic plant, a native of England. The leaves are submerged, and large purple flowers rise on a long stalk above the water.

HOUND'S-TONGUE, *hownds'-tung.*—A genus of plants (*Cynoglossum*) of the natural order *Boraginæ*. The common Hound's-tongue (*C. officinale*) is found in nearly all parts of the world. It has downy leaves, small purplish flowers, and emits a disagreeable odour. The root was formerly considered a remedy for scropila, dysentery, and hydrophobia.

HOUR, *owr* (Lat., *hora*), the twenty-fourth part of the space of time that elapses between two successive periods of midnight or midday, or the time during which the earth completes an entire revolution about its axis, and in which a complete apparent revolution of the sun through the heavens is effected. An hour, in angular measurement, is equivalent to 15 degrees of space, being the twenty-fourth part of 360 degrees. The hour is subdivided into 60 minutes in time, and each minute into 60 seconds. The Greeks and Romans divided the period of daylight into twelve hours, taking no notice of the night, consequently the hours differed in length every day. The Chinese hour is equal to two of ours. Astronomers reckon from midday to midday, counting from 1 to 24; the ordinary two o'clock in the morning, for instance, being marked on astronomical clocks as 14.

Hour-Circle.—The meridian of any place, or any great circle of the globe passing through the poles, is so called, because the hour of the day at any place can be ascertained, when the great circle on which the sun happens to be at that time is known.

HOUSE-FLY.—One of the best known of all insects (*Musca domestica*), belonging to the family *Muscides*. The proboscis and feet of the house-fly are very interesting microscopic objects. The feet are thickly covered with hairs, terminated by minute discs, which act as suckers, and from which a liquid exudes, which perhaps assists the adhesion of the foot to perpendicular walls and ceilings.

HOUSE-LEEK.—A genus of plants (*Semperirrum*) of the natural order *Crassalaceæ*. The Common House-Leek grows wild in rocks on the Alpine districts, and is cultivated on walls and roofs in most parts of Europe. The leaves, cut or bruised, afford great relief as outward applications to stings from bees or wasps, and to ulcers and inflamed sores, and were formerly thought to be valuable remedies in cases of fever. An old name was "Jupiter's Beard," and the plant is so styled in an edict issued by Charlemagne, ordering it to be grown throughout his dominions.

HOVEN, *ho'-ven.*—A complaint to which cattle and sheep are liable, resulting from eating improper food, which causes a distention of the stomach with gas.

HOWLING MONKEYS.—The largest of American monkeys (*Mycetes*) found in the northern part of South America. They have a peculiar formation of the throat, which enables them to produce sounds which may be heard at a distance of several miles, from which they are sometimes known as Stentors. They are of low intelligence and very fierce. They are gregarious in habit, and swing themselves from branch to branch with remarkable activity.

HOYA, *ho-ya.* (*See* WAX PLANTS.)

HUANACA, OR GUANACO, *hoo-an'-a-ka.*—A species of Auchenia (*A. Huanaca*), a native of the South American Indies and Patagonia. It is of the same genus as the Llama and Alpaca, of which it is possibly the wild original.

HUMBLE-BEE. (*See* BEE.)

HUMERUS, *hu-'me-rus* (Lat.).—The bone of the arm. It constitutes the first of the radiated system of bones of the anterior extremity in vertebrated animals, articulated with the scapula.

HUMIRIACEÆ, *hu-me-re-ai'-se-e.*—The *Humirium* family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*, consisting of three genera, and one species, all natives of tropical America. They are trees or shrubs with a balsamic juice. From the incised stem of the species *Humirium Floribundum*, a yellow liquid, called balsam of umiri, is obtained: this is said to resemble copaiba and balsam of Peru in its properties. Other species are said to yield useful balsamic liquids.

HUMMING-BIRDS, OR TROCHILIDÆ, *hum'-ming.*—A family of very small and exquisitely beautiful birds belonging to the tenuirostral tribe of the order *Passeres*. This family contains a great number of species, above 300 having been described, and they have been divided into many genera and sub-genera. They are active little birds, and from the structure of their frames, it is apparent that they were intended to pass most of their time on the wing. Their food consists of small insects, and perhaps the nectareous juices of flowers, which their tongue is admirably fashioned for obtaining. This organ is very long, and can be darted out of the bill to a considerable length by a sudden motion like that of a spring. Their feet are small, generally dark-coloured, and in several species which live high up in mountainous regions the tarsi are warmly protected with large white plumets, giving them the appearance of having downy muffs on their legs. Their wings are very long and narrow, and they are, by means of the rapid motion given to them, able to balance themselves in the air, hovering round flowering shrubs and plants, probing their tubular nectaries, and at the same time emitting a pretty loud humming noise, caused by the concussion of their wings with the air; whence their English name, "humming-birds." They are exclusively seen in the New World, of which they are natives; and are found from one extent of the vast continent of America to another, though in greatest abundance in the tropical parts, in the deltas, and along the banks of the great rivers both of the North and South. Humming-birds are also found in great abundance in the West-Indian Islands, where, also, some species may be seen which do not occur on the mainland. One of these in particular, termed the *Mellisuga humilis*, has a very sweet note and is perhaps the only species of the family that has a real song. The male bird of this variety is about 2½ inches in length, and is exactly like a bumble-bee when darting about in the air. The nests of the humming-birds are wonderfully made with cotton, wool, and twigs, beautifully interwoven with feathers, and lined with down; and almost all the species lay two eggs, which in some cases are extraordinarily small. The *Trochilus colubris*, or "ruby-throated humming-bird," is a beautiful species, about 3½ inches in length, the body glittering with green and gold, and the throat and chin glowing with a beautiful ruby-colour, like that of a live coal. The smallest species of all is the *Mellisuga minima*, which is only about one inch and a quarter in length, and which weighs but twenty grains.

HUMOUR, *hu'-mor* (Lat. *humus*, the ground, because moisture was supposed to spring from the ground).—A general name for any fluid, but more especially applied to the fluids of the human body, and often to these in their morbid state. The term is used without any reference to disease, in speaking of the fluids of the eye.

HUMUS, *hu'-mus.*—A term applied in chemistry to a group of substances which form the constituents of the organic matter of the soil. They are generally divided into three classes—those which are soluble in water, those which are soluble in alkaline solution, and those which are quite insoluble.

HUNGER, *hung'-ger* (Sax.).—A peculiar sensation experienced in the regions of the stomach, in consequence of the want of solid food. The sensation of hunger is at first rather agreeable, but it quickly becomes unpleasant when prolonged. But although the want of food causes hunger, it does not itself constitute hunger. Food may be absent without the sensation of hunger. Idiots and insane people frequently subject themselves to prolonged fasting without any hungry cravings. Violent emotions of grief or joy destroy the sense of hunger and the sensation may be allayed by opium, tobacco, and even inorganic substances, such as clay, although none of these can supply the deficiency of food. In the case of those animals which remain torpid for a certain portion of the year, no food is taken, and no hunger experienced. (*See* HIBERNATION.)

HUON PINE, *hu'-on*. (*See* DACRYDRUM.)

HURA, *hu'-ra*.—A genus of plants of the natural order *Euphorbiaceæ*. One of the best known species (*H. crepitans*) is a native of the West Indies and tropical America, and is commonly known as the Sandbox tree, the capsule, or fruit, about as large as an ordinary apple, being formerly used for powdering letters with fine sand, before blotting-paper was in common use. The seeds are administered as a strong purgative, and the tree yields an acrid juice of a milky appearance.

HURRICANE, *hur'-re-kain* (Span., *huracan*), a most violent storm, generally accompanied by thunder and lightning, and distinguished from every other kind of tempest by the extreme violence of the wind, and by its sudden changes. Hurricanes occur most frequently in the East and West Indies, Mauritius, and some parts of China. The West-Indian hurricanes usually occur in the rainy season, during the month of August, and sometimes, but rarely, in July and September.

HYACINTH, *hi'-a-sinth* (Lat., *hyacinthus*), a genus of plants of the natural order *Liliaceæ*. They are bulbous-rooted, with bell-shaped flowers. The numerous and splendid varieties of the garden hyacinth (*H. orientalis*) have always been general favourites; and the fondness for these flowers in some countries almost amounts to a mania. It is a native of Persia, Asia Minor, and Syria, and is now naturalized in some parts of the south of Europe. It has broad linear leaves, with a raceme of many flowers. The colours of the cultivated hyacinth vary greatly, and are chiefly white, purple, and blue; many of them are double. The fragrance of the hyacinth is most powerful. In Holland more than 2,000 varieties have received distinct names, and enormous prices have been given for single plants. The environs of some of the Dutch towns present, through the profusion of these flowers, a gorgeous appearance. Hyacinth bulbs, planted in pots or grown in hyacinth-glasses, produce beautiful flowers. Rain-water is better than spring water for filling the glasses; the water should not be changed, but the glass filled up to supply the loss by evaporation. A piece of charcoal will purify the water. The glasses should be kept in a dark, cool place until roots have been sent out. The cultivation of hyacinths in the open ground is attended with difficulties.

In Mineralogy, a hyacinth is a brilliantly-coloured variety of Zercon, also a fine red cinnamon stone, and the name is sometimes given to a red kind of ferruginous quartz.

HYÆNA, *hi-é-na* (Lat.).—A tribe of animals (*Hyænia*) of the class *Mammalia*, order *Feræ* and family *Felidæ*. They are digitigrade animals, with more or less elongated limbs, and the body depressed posteriorly. The type of the family is the genus *Hyena*, the species of which are characterized by the possession of four toes on each foot; thick, short, and blunt claws; and no small tubercular teeth in the lower jaw behind the molars. The dentition is regular; thirty-four teeth in number, eighteen in the upper and sixteen in the lower jaw. There are five molar teeth on each side in the upper jaw, and only four on each side in the lower. By the structure of their teeth, the hyænas are able to crush the bones of even the largest prey, and the muscles of their jaws and neck are so powerful that it is almost impossible to take anything from them that they have seized. In habits they are less sanguinary than animals of a similar nature to themselves, and live more on dead prey, even preferring flesh that has become quite putrid. The muzzle is obtuse, like that of a dog, and the tongue rough and furry, like that of a cat. They are nocturnal animals, and are useful in Eastern cities, where they act the part of scavengers, and carry off all refuse and decomposing bodies during the night. The family of the hyænas are natives of Asia and Africa, and the common *Hyæna* (*vulgaris*), or *striped* hyæna (*Hyæna striata*), is the best known of the different species. It is of a yellowish-grey colour, and the skin is crossed by deep transverse black bands. From the neck along the back a long black main, mottled with yellow hair, extends to the tail, while the ears are of a brown colour, and nearly naked, broad at the base, long and erect. Of solitary retiring habits, it is however, easily tamed by man, and will take the place of a faithful watch-dog, refuting the old but unfounded idea that the hyæna is untameable. It is called the *strand wolf* by the inhabitants of the Cape of Good Hope, where a variety of it is found. The spotted hyæna of the Cape (*H. crocuta*), or tiger-wolf, is smaller than the last-mentioned animal, and is of a brownish-yellow colour, diversified with numerous dark-brown or black spots. It utters a strange cry, resembling hysterical laughter. The remains of hyænas have been found in most tertiary formations over the greatest part of Europe, and one variety, *H. spelæa*, has been found in nearly every part of England.

HYA-HYA. (*See* COW TREE.)

HYBERNATION. (*See* HIBERNATIA.)

HYBODUS, *hi'-bo-dus* (Gr., humptooth).—A genus of fossil-fish, including about 50 species, some remains of which are found in the secondary rocks, from the trias to the chalk. In some respects they resembled sharks, but instead of the sharp-pointed teeth characteristic to that family, had broad, blunt teeth, each having a central cone and smaller cone around it, adapted for crushing, not for tearing.

HYBRID, *hi'-brid* (Gr., *hubrizo*, I outrage). A mongrel produced, whether in plants or animals, by the impregnation of the female of one species, genus, or race, by the male belonging to a different family. The commonest sorts of hybrids are those which arise from the interconnection of different varieties of the same species. The best-known hybrid is the mule, the product of the intermixture of the horse and the ass. Other animals (most frequently birds) will occasionally interbreed; and hybrids of flowers have been produced. Hybrids are nearly always sterile, and generally partake more of the characteristics of the male than of the female parent.

HYDARTHRUS, *hi-dar'-thrus* (Gr., *hudor*, water; *arthron*, a joint), a white swelling. The joints most subject to this disease are the knee, ankle, elbow, and wrist. It can be distinguished from rheumatic swelling of the joints by its fixed and wearing pain, which often exists for a long time before any enlargement of the part is perceptible.

HYDATID, *hi'-dat-id* (Gr., *hudatis*, a watery vesicle).—A term applied rather vaguely to various cyst-like productions, which are sometimes found in the bodies of men and animals. Under the common denomination of hydatids are included several very dissimilar objects. First, several species of entozoa, or parasitic animals, which have a distinct and separate vitality; secondly, simple, unattached cysts; and thirdly, vesicular bodies, either wholly or partially connected with the tissues surrounding them. Hydatids are principally found in the bodies of mammals, and rarely in those of the lower animals. The cysticercus, the cœnurus, and the echinococcus are the principal forms of cystic entozoa recognized. The first of these is often generated in the disease of sheep called "the rot." Another species affects the hog, and produces the disease called leprosy, or measles. The *Polycephalus ovinus*, another hydatid of this kind, is found in the brain of sheep, oxen, and other ruminating animals. This disease is sometimes called "the staggers" in England. Hydatids generally occur in a disordered state of health; consequently, the best remedies are those which are likely to improve the general health.

HYDNUM, *hid'-num*.—A genus of fungi (*Hymenomycetes*), of which there are many species, some of them British. The under side of the pileus is covered with short spines. One species (*H. repandum*) is eaten in France, Germany, and Italy.

HYDNOCARPUS, *hid-no-kar'-pus* (Gr., *hudnon*, tubercle; *karpos*, fruit).—A genus of the natural order *Pangiaceæ*, consisting of arborescent uni-sexual plants, found in the hotter parts of India. The species *H. venenatus* has a poisonous fruit, which is used for stupefying fish. The seeds of *H. odoratus*, commonly termed *Chaulmoogra*, are employed by the Indian doctors as a remedy in some cutaneous affections.

HYDRA, *hi'-dra* (Gr., *hudra*, the water-snake), a constellation of the northern hemisphere. It is figured on the celestial globe as a snake of great length, with a cup on its back, and a crow between the cup and the extremity of the tail. As it extends over such a great space in the field of the heavens, it has been divided into four parts, distinguished as *Hydra*, *Hydra* and *Crater* (the cup), *Hydra* and *Corvus* (the crow), and *Hydræ continuatio*, or the continuation of Hydra. The largest star in the entire constellation is of the second magnitude.

Hydra.—A fresh-water Polype, the type of the class Hydrozoa. (*See* ZOOPHYTES.)

HYDRACIDS, *hi-dras'-sidz*, acids in which hydrogen is the acidifying principle. The principal hydracids are the hydrochloric, hydrobromic, hydriodic, and hydrofluoric.

HYDRAGOGUE, *hi'-dra-gog* (Gr., *hudor*, water; *ago*, I expel).—Violent cathartics, which bring away a large quantity of watery secretion from the intestines. Jalap and the very powerful elaterium are among the best known hydragogues.

HYDRANGEACEÆ, *hi-dran-je-ai'-se-e* (Gr., *hudor*, water; *aggeion*, vessel).—The *Hydrangea* family, a natural order of *Dicotyledones*, in the sub-class *Calycifloræ*. About one-half of the species are natives of China and Japan. The typical genus *Hydrangea* contains some familiar cultivated plants—as *H. arborescens*, *quercifolia*, and *hortensis*. The latter is the common garden hydrangea, which is much valued for its large fresh-looking leaves and dense bunches of rose-coloured, white, or blue flowers. It was introduced into England by Sir Joseph Banks in 1788. This plant requires a constant supply of water in warm weather, and in places where the atmosphere is moist and warm, as in Devonshire and the Isle of Man, grows to a great size and makes a splendid shrub. The leaves of *H. Thunbergii* form the *Ama-tsjâ*, or tea of heaven, of the Japanese. The root of *H. arborescens* is used medicinally in calculus complaints in some parts of North America, under the name of Leven bark.

HYDRARGYRUM, *hi-drar'-je-rum* (Lat.), quicksilver, or mercury. (*See* MERCURY.)

HYDRASTIS, *hi-dras'-tis* (from Gr., *hudor*, water).—A genus of the natural order *Ranunculaceæ*. One species only is known, namely, *H. Canadensis*, the golden seal, orange root, or ground raspberry. This is a low perennial herb, indigenous to North America. Its rhizome, or root-stock, sends up, in early spring, a simple stem, from six inches to a foot high, which is two-leaved near the summit, and bears a single, terminal greenish-white or rose-coloured flower. The fruit is of a red colour, and somewhat resembles an unripe raspberry. Two active principles, *hydrastina* and *berberine*, have been extracted from the rhizome. The preparations of *H. Canadensis* are stated to have a specific influence over the mucous surfaces. There can be no doubt as to the valuable tonic properties of this plant.

HYDRATES, *hi'-draits* (from Gr., *hudor*, water).—In combination with certain metallic oxides, water seems to play the part of an acid, forming a compound that may be considered as a pseudo salt. The combination of water with the oxides is always attended with the evolution of a large amount of heat, a familiar instance of which takes place in the slaking of lime. In the case of oxide of potassium and sodium, the action is so violent that the mass becomes incandescent.

HYDRAULICS.—That portion of Natural Philosophy which treats of fluids in motion and the methods by which useful results are obtained from them. (*See* HYDRODYNAMICS.)

HYDRIDÆ, *hi'-dri-de*.—A family of serpents in which some naturalists include some non-venomous fresh-water snakes. More generally, however, the name is limited to venomous sea-serpents, inhabiting the tropical seas, in the eastern hemisphere, and which form the genus *Hydrus*. They swim like eels, are generally of a yellowish-green colour, and vary from two to five feet in length. More than fifty species are known.

HYDROCARBONS, *hi'-dro-car'-bonz*.—The hydrocarbons, in organic chemistry, fall into three groups:—1, Those which are homologous with olefiant gas; 2, those which are called alcohol radicles; and, 3, those which are homologous with marsh grass. There is an extensive series of double hydrocarbon radicles, formed by the combination of two alcohol radicles. Thus, we have ethyl-tetryl, methyl-ethyl, and so on. The great majority of hydrocarbons are gaseous. They are mostly obtained by the destructive distillation of wood, coal, and similar bodies.

HYDROCELE, *hi'-dro-seel* (Gr., *hudor*, water; *kele*, a swelling).—Dropsy of the membrane or sac investing the testes. It forms a pear-shaped swelling which gives no pain and does not exhibit tenderness, and sometimes is the result of acute inflammation, but ordinarily no cause for its appearance can be traced. It generally occurs about the middle period of life, and persons of a feeble or gouty constitution are most subject to it. The quantity of serous fluid seldom exceeds from 15 to 20 ounces, but cases have been known in which there were 100 ounces. Injection of tincture of oxidine, or the passage of a fine seton or wire is generally resorted to.

HYDROCEPHALUS, *hi-dro-sef'-a-lus* (Gr., *hudor*, water; *kephale*, the head).—A term applied to dropsy, or water in the head. There are three kinds—the acute, chronic, and spurious, or hydrocephaloid disease. Acute hydrocephalus is an inflammatory disease occurring in infancy, rapid in its course, and requiring decided treatment; chronic hydrocephalus, on the other hand, may go on for many years. In acute hydrocephalus, the child is usually restless and fretful, the skin is hot and dry, the pulse quickened, the appetite is lost, and the bowels costive. The eyes are dull and heavy, the face flushed, and the child complains of pain and heaviness of the head. After a time, the symptoms become more manifest. The pain in the head becomes more intense, the restlessness is much increased, the expression of the countenance is altered, especially that of the eyes, which are often directed irregularly, with the pupils unequally dilated. Acute hydrocephalus often proves fatal in two or three days, or even less; but sometimes it is protracted over two or three weeks, depending chiefly upon the age and strength of the child and the violence of the disease. The treatment of this disease must necessarily depend upon the strength and condition of the patient, the great object being to subdue the inflammatory action of the brain. Blood is to be freely abstracted by leeches, and some recommend the free use of the lancet. Active purgatives are also to be administered. Chronic hydrocephalus differs from the other, not only in its progress being much slower, but from being rarely, or only slightly, attended with inflammation, and from there being always more or less of a collection of watery fluid in the brain, which is not invariably the case with the former. The chronic form is frequently hereditary, occurring in the children of weak or scrofulous parents, and it usually makes its appearance before or speedily after birth. The fluid sometimes amounts to many pints, giving the head a very large and unsightly appearance. The duration of the disease is extremely various; sometimes it may terminate fatally in a few months, at other times it may go on for many years. From the early period at which this disease usually makes its appearance, little can be done to arrest its progress. Sometimes puncturing the head has been attempted with success. Spurious hydrocephalus presents many of the symptoms of the acute form of the disease, but is not inflammatory, and is due to debility and a deficient supply of blood to the brain. It readily yields to the effects of nourishing diet and tonics.

HYDROCHARIDACEÆ, *hi-dro-ka-re-dai'-se-e* (Lat., *hydrocharis*, the plant frog-bit).—The Frog-bit family, a natural order of *Monocotyledones*, sub-class *Petaloideæ*. The plants of this order are inhabitants of fresh water in Europe, North America, the East Indies, and Tasmania. The fresh water aquarium has made many of these simple plants familiar objects. One of them, *Vallisneria spiralis*, is the best and most lasting of all aquarium plants. *Anacharis alsinastrum*, the American water-weed, or water-thyme; *Stratiotes aloides*, the water-soldier; and *Hydrocharis Morsus-Ranæ*, the frog-bit, are also plants of this order.

HYDROCOTYLE, *hi-dro-ko'-tile* (Greek, *hudor*, water; *kotule*, a cup or hollow vessel).—A genus of *Umbelliferæ*. The only British species is known as Marsh Pennyworth (*H. vulgaris*). It grows in marshy places, and is sometimes called white rot, from a not very well-founded notion, that if eaten by sheep it causes the foot-rot and other diseases. An Asiatic species is used both externally and internally, as a remedy for leprosy and other skin diseases.

HYDRODYNAMICS, *hi-dro-di-nam'-iks* (Gr., *hudor*, water; *dunamis*, power), that branch of science which treats of the pressure, equilibrim, cohesion, and motion of fluids; and also of the machines by which water is raised, or in which water is used as the first mover. The subject is divided into two parts—hydrostatics and hydraulics. The former includes the pressure, cohesion, and equilibrium of fluids, while the latter comprehends their motion, together with the machines with which they are connected. Many of the laws of hydrodynamics depend greatly upon the characteristic property of fluids; namely, that of *transmitting equally in all directions pressures applied at their surfaces.* The general principles upon which the science of hydrostatics is founded were first given by Archimedes, who maintained that each particle of a fluid in equilibrio is equally pressed in every direction. The first attempts at the construction of hydraulic machinery were made in the Greek school at Alexandria, which flourished under the patronage of the Ptolemies. The fountain of compression, the siphon, and the forcing-pump, were invented by Ctesibus and Hero, about 120 years after the birth of Christ. (*See* PUMP and SIPHON.) The fountain of Hero, as it is usually called, is a machine, the principle of which depends upon the transmission of the pressure sustained by a body of water in one vessel to that in another, by means of the elasticity of air. Notwithstanding these inventions of the Alexandrian school, its attention does not seem to have been directed to the motion of fluids. The first attempt to investigate this subject was made at Rome, in the reigns of Nerva and Trajan. From that time very little advance was made in hydrodynamics till the end of the 16th century, when the discoveries of Castelli and Torricelli gave a new direction to the science of hydraulics. The discoveries of Sir Isaac Newton and other philosophers have caused this branch of science to progress rapidly in later years. Euler gave the general formulæ for the motion of fluids, founded on the laws of their equilibrium, and thus reduced the whole mechanics of fluid bodies to a single question of analysis. Hydraulic machines are of great variety. They are of two kinds—machines having a motion of rotation, and machines having an alternate motion. Descriptions of different kinds are given under the respective names of each.

HYDROGEN, *hi'-dro-jen* (Gr., *hudor*, water; *gennao*, I produce).—An elementary substance, first isolated as a constituent of water by Cavendish in 1766; but, under the name of combustible air, was more or less known to earlier chemists. It is a colourless, transparent, tasteless, inodorous gas, permanent at all temperatures, and resisting all efforts to liquefy it. It is almost insoluble in water, 100 volumes of that fluid only absorbing two volumes of the gas. It is the lightest substance in nature, 100 cubic inches of it weighing only 2·14 grains. The chemical symbol is H. In combination with water, it is most extensively distributed throughout nature. It also exists in combination with hydrogen in most inflammable minerals. It is an important element in all organic substances, and enters into the composition of most substances in daily use, whether drawn from the mineral, vegetable, or animal kingdoms. Having a very great attraction for oxygen and chlorine when in the nascent condition, it is much employed in the laboratory for deoxidizing or dechlorinating purposes. It is prepared in a variety of ways, the most usual being by pouring dilute sulphuric acid on granulated zinc or iron clippings. It may also be prepared by passing steam over red-hot iron filings, by plunging sodium or potassium into water, or by electrolysis of water; all of which methods are more scientifically interesting than practical. When zinc and dilute sulphuric acid are used, the gas passes off rapidly, and may be collected over water. Prepared in this way, it contains a number of impurities, such as arsenic, sulphur, antimony, &c.; but these may be removed by passing the gas through solutions of hydrate of potash, nitrate of silver, and oil of vitroil. Mixed with air, it may be breathed without any other effect than raising the pitch of the voice. Mixed with oxygen, olefiant gas, or atmospheric air, it forms an explosive compound of great power. The real nature of hydrogen has long been an interesting point of discussion amongst chemists, many supposing it to be a metal in a gaseous form. Its power of being replaced by metals in its combinations has led Gerhardt and others to classify metals in accordance with their hydrogen-replacing power. Most metals replace one atom of hydrogen in its combinations, such as potassium, sodium, zinc, &c.; others replace two atoms of hydrogen, such as palladium, platium, and tin; others again replace three atoms of hydrogen, such as bismuth, arsenic, and antimony. Others replace three atoms of hydrogen, by two of metal; such as aluminium, iron, and manganese; while there are others, two atoms of which replace one of hydrogen. Hydrogen is not only replaced in its compounds by metals, but also by complex organic compound atoms; such as ethyl, methyl, &c. Hydrogen is used principally in the oxy-hydrogen blowpipe.

HYDROMUS, *hi'-dro-mus*.—A genus of rodent quadrupeds of the family *Muridæ*. There are only two known species known in Tasmania, of which they are natives—Beaver Rats. They swim well either in fresh or salt water. The largest species is twice the size of a common rat.

HYDROPATHY, *hi'-drop-a-the* (Gr., *hudor*, water, and *pathos*, disease), is a mode of curing disease, by means of the application of water. The advantage of a free external use of cold water as a remedy for acute complaints has had many advocates since the time of Hippocrates; but the present system owes its origin to one Vincenz Priessnitz, a peasant farmer who, in 1826, established an institution at his native place, Gräfenburg, in Austrian Silesia, for the cure of diseases on this mode. The system soon spread, and now there are in this country many large and well-appointed hydropathic establishments. The system of treatment is of benefit in cases of indigestion, nervousness, an impaired constitution, a too full habit, or in such as have been living freely, without taking much exercise. The system of dietary and exercise that is kept up at these places is perhaps not less conducive to a cure than the baths. It was an axiom of Priessnitz's, "Man must have mountains," and most "water-cure" establishments are in hilly districts. The baths used are very various. Besides the ordinary bath and the shower bath, one of the most common is the douche bath, in which a single jet of water, varying in size from the thickness of a quill pen to that of a man's arm, is projected with great force, either from above, below, or one side, upon a particular part of the body. The sitz bath is taken sitting; besides which there are the foot-bath, hand-bath, &c. Sometimes, when the patient is sitting in a warm or tepid bath, cold water is poured over the head and upper part of the person. Pieces of coarse linen, saturated with cold water, are also applied to the skin, and covered over with dry cloths, and usually remoistened several times a day. The wet sheet packing is one of the characteristics of the system. It consists in the patient being closely enveloped in a sheet, wrung out of cold water, and then covered over with dry blankets. The great importance of hydropathy consists in the healthy stimulus which it gives to the nerves, bracing them, and acting as a tonic and soother to the whole system.

HYDROPHOBIA, *hi-dro-fo'-be-a* (Gr., *hudor*, water, and *phobeo*, I fear).—A disease occasioned by the bite of a rabid animal, and so called from the great dread that those who suffer from it manifest at the sight of water. The dog, cat, fox, and wolf are the animals among which this disease is most common—among whom it is natural; but there is perhaps no animal to which it is not capable of being communicated, as it is to man. The poison exists in the saliva of the rabid animal, and may be communicated either by a bite, or by licking a wounded part. After the poison has been received, the wound usually heals up in the ordinary way. At a period, however, varying from a month or six weeks to perhaps eighteen months, symptoms of the disease begin to manifest themselves. The part becomes painful, red, and swollen, and shooting pains are felt, extending from it to the central parts of the body. Very soon after this (within a few hours perhaps, but certainly within a few days), the specific constitutional symptoms make their appearance; the sufferer is flurried and irritable; speaks of pain and stiffness, perhaps about his neck and throat; unexpectedly he finds himself unable to swallow fluids, and every attempt to do so brings on a paroxysm of choking and sobbing, of a very distressing kind to behold. The symptoms rapidly increase in severity. The nervous irritability becomes extreme, the paroxysms are greatly more violent, and are excited not only by any attempts to swallow liquids, but by the very sight or sound of them; even the waving of a polished surface, as of a mirror before the eyes, or the passage of a gust of wind across the face, being sufficient to excite it. Death occasionally takes place within twenty-four hours, but sometimes it may be protracted to the fifth or sixth day; usually, however, it terminates fatally on the second or third day. Nothing can be said to be known of the nature or character of this disease, and as little is known regarding its treatment. Various means have been tried, but few, or any of them, have met with any success, and none of them have received general adoption. It is not, however, every one that is bitten by a rabid animal that has hydrophobia. John Hunter records that in one case twenty-one persons were bitten by a mad dog, and only one of them had hdyrophobia; and others have come to the conclusion, that on an average, only one person in twenty-five bitten will have hydrophobia. In many cases, probably, the virus is removed by the clothes through which the teeth of the animal passes. In the treatment of this disease, the great thing is to remove the poison before it has extended itself into the system. This is best done, where possible, by excision of the wounded part, care being taken that every portion of it is removed. Where it is impossible to use the knife effectually, a powerful caustic should be applied freely over the whole surface of the wound, so as to destroy the effect of the poison. As the poison is not very active, these means are usually effective, though employed some time after the receipt of the wound; but, of course, in such circumstances, all due haste is to be adopted, and it is well, before the arrival of medical assistance, to keep carefully washing the part with tepid water.

HYDROPHYLLACEÆ, *hi-dro-fil-lai'-se-e.*—The *Hydrophyllum* family, a natural order of *Dicotyledones*, sub-class *Corolliflorœ*, consisting of herbs, bushes, and small trees. There are about 80 known species. The plants of this order are chiefly natives of the northern and most southern parts of the American continent. Many of them are cultivated in our gardens, and are highly valued for their pretty flowers. The most common are the species of *Nemophila* and *Hydrolea*.

HYDROSTATICS, *hi-dro-stat'-iks* (Gr., *hudor*, water; *statikos*, static, standing, or settling). (*See* HYDRODYNAMICS.)

HYDROTHORAX, *hi'-dro-tho'-rax.*—Dropsical collections in the pleura, the sac enveloping the lungs. Cupping, blistering, and calomel are generally resorted to as remedies.

HYLÆOSAURUS, *hi-le-o-saw'-rus* (Greek, *hyle*, weald or forest; *sauros*, lizard).—One of the gigantic terrestrial lizards, remains of which were discovered by Dr. Mantell in the Wealden strata of Tilgate Forest. It is inferred, from the size and form of the bones of the head and jaws, that the creature must have attained a length of from twenty to thirty feet. The body was broader than high, and terminated by a long flexible tail; the limbs were relatively short; the skin was covered with scales and tubercles; and a row of very large, thin, angular spines extended down the back, and formed a serrated dermal crest. A model of this gigantic creature may be seen in the grounds of the Crystal Palace.

HYMENÆA, *hi-men-e'-a* (from Gr. *humen*, a membrane).—A genus of the natural order *Leguminosæ*, and sub-order *Cæsalpinieæ*. The species *H. Curbaril*, the West-Indian locust-tree, is supposed to yield gumanime or East-Indian copal. The inner bark is stated to possess anthelmintic properties. The fruit contains a mealy substance, in which the seeds are imbedded, sweet and grateful to the palate: this, when boiled and allowed to ferment, forms an intoxicating drink resembling beer. The timber is close-grained and tough, and is well adapted for planking vessels. The gum known as copal is obtained from dies of this genus.

HYMENOPTERA, *hi-men-op'-te-ra* (Gr., *humen*, a membrane; *pteron*, a wing), one of the orders into which insects are divided. They are characterized by possessing four membranous wings, of which the anterior pair are the larger, and they cross horizontally over the body when in a state of repose. Of all the orders into which insects are separated, the hymenoptera contains the largest number remarkable for development of instinctive powers and social qualities. Hymenopterous insects are remarkable for the great development of the aërial tracheæ, which, in many species, are placed in their abdomen, in pouches, and are very large in comparison with the size of the insects. They undergo what is termed incomplete metamorphosis; and in the greater number the larvæ are soft, whitish-coloured, and destitute of feet. In the imago, or perfect state, most hymenopterous insects live upon flowers, or, at least, often frequent them, some for the purpose of gathering honey, and others in order to find a safe retreat from whence they can attack their prey. The best-known families of the *Hymenoptera* are the bees, the wasps, and the ants. (*See* those headings.)

HYOSCYAMUS, *hi-os-i'-a-mus* (Gr., *huoskuamos*), Henbane, a genus of the natural order *Atropaceæ*. The common henbane, *H. niger*, is an indigenous plant, growing on waste grounds, banks, and commons. It is glandular and viscid, and exhales a peculiar odour, which is fœtid and powerful. It blossoms in June or July, the flowers being of a pale straw-colour, beautifully pencilled with purple veins. The whole herb possesses narcotic properties, and has been employed medicinally from the earliest times as a narcotic, anodyne, and soporific. It is sometimes used by oculists in place of belladonna to dilate the pupil. When swallowed in sufficient quantity, it is stated to cause loss of speech, disturbance of vision, distortion of the face, coma, delirium, phantasms, and paralysis. No antidote is known. Its activity is essentially due to the presence of the alkaloid *hyoscyamia*. Two varieties of henbane are commonly cultivated—the *annual* and the *biennial*, the latter being generally regarded as the most active in its properties. The leaves only are used in regular practice: they are given internally in the form of powder, or in extract or tincture, and applied externally in fomentations or cataplasms. The fumes of the seeds heated in the bowl of a tobacco-pipe were formerly inhaled to allay toothache.

HYPERBOLA, *hi-per'-bo-la* (Gr., *huper*, above; and *bolé*, from *ballein*, to throw), the name of one of the curves that are known as conic sections. (*See* CONIC SECTIONS.) It is formed by cutting the cone in a plane that passes through it in a direction parallel to its axis.

HYPERICACEÆ, *hi-per-e-kai'-se-e.*—The St. John's Wort family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*, consisting of herbs, shrubs, and trees. There are about 300 species, which are generally distributed over the globe, and are very numerous in North America. They have commonly a resinous yellow juice, which is frequently purgative, as in the species of *Vismia*. Some have tonic and astringent properties, as *Hypericum perforatum* (the common St. John's Wort) and *Androsæmum officinale;* and some again have diuretic properties, as *Cratoxylon Hornschuchia.*

HYPERSTHENE, *hi'-pers-theen.*—A crystalline bisilicate of iron and magnesia, which when cut and polished, is made up into rings and brooches. The colour is red, with a pearly lustre. The finest kind is found on the coast of Labrador; and it is also obtained in the north of Europe and Scotland. In connection with felspar it forms a kind of trap-rock, known as hypersthene rock.

HYPERTROPHY, *hi'-per-tro-fe* (Gr., *trophe,* food), the enlargement of certain organs of the body, sometimes development caused by extreme exertion, and sometimes the result of disease. In hypertrophy of the fatty tissue, constituting obesity, there is an excess of fat in the blood.

HYPHÆNE, *hi-fe'-ne.*—A genus of palms. *H. Thebaica* is the Doum palm of Egypt, sometimes known as the gingerbread-tree, from the resemblance of the pericarp of its fruit to gingerbread. Unlike most of the palms, this has a stem forked above, and this mode of growth is continued with the successive branches.

HYPNOTISM, *hip'-not-ism* (Gr., *hypnos,* sleep).—A state of insensibility produced by looking intently at a bright object held about a foot from the eyes of the person experimented on, and in such a position above the forehead that a great strain on the eyes is produced. In addition to fixing the gaze intently on the object, it is necessary also to concentrate the thoughts upon it. Not only is apparent sleep produced, but rigidity of the limbs, and such a condition of insensibility that some of the minor operations of surgery can be performed without any pain being felt. The effects, indeed, are almost identical with those produced by mesmeric power. It is remarkable that the effect can be produced on blind persons; and the late Mr. Braid, of Manchester, who first observed the phenomenon, considered that "it was not so much the optic, as the sentiment motor and sympathetic nerves and the mind through which the impression is made." Some years ago, several so-called "professors of electro-biology," gave public exhibitions of their power of producing insensibility as a result of looking intently at metallic discs placed in certain positions; that is, they produced a state of hypnotism. Such experiments with the susceptible nervous system are not to be encouraged.

HYPOCHONDERS, *hip'-o kon-ders* (Greek, *hupo,* under; *chondros,* a cartilage).—The two lateral and superior regions of the abdomen.

HYPOCHONDRIASIS, *hip-o-kon-dri'-a-sis.*—A disease characterized by extreme sensibility of the nervous system, leading the patient to believe himself to be suffering from some terrible and imaginary disease, or to be something very unlike his real self. The ideas of such persons often partake of the most extravagant character. He may fancy that he is immensely tall, or inordinately small; that he is heavy as lead, or light as a feather; that he is composed of glass, or is a lump of butter. They are all extremely timid, and their fears are exercised upon trifles, or are altogether groundless. The causes of this disease are various, arising as it does usually from an impaired condition of the nervous system. Young men of studious habits are very apt to suffer from this disease. Those too, who, from want of occupation and a due amount of exercise acquire a luxurious habit, often fall a prey to it. In females, hysterics frequently accompany the ordinary symptoms. The disease in some cases amounts to active insanity.

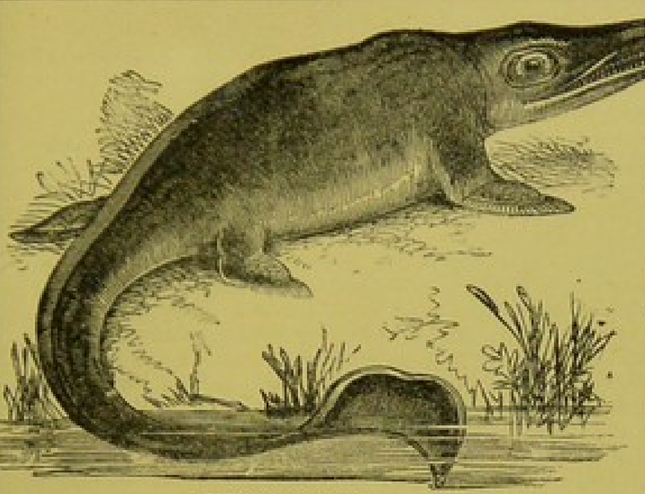
HYPOGYNOUS, *hi-poj'-e-nus* (Gr., *hupo,* under; *gune,* female).—A term applied in Botany to the stamens when they are free from the calyx and pistil, and arise from the thalamus or torus below the latter organ: this is the normal position of the stamens, and may be observed in the poppy and ranunculus. The term is also applied to the corolla when it arises from below the pistil and free from the calyx. The name *Hypogynæ* has been given to a subdivision of the *Petaloidæ,* from the perianth being free and the ovary superior.

HYPOLHÆRIS, *hip-o-ke'-ris.*—A genus of plants of the natural order *Compositæ,* sub-order *Cichoraceæ.* One species, popularly known as the long-rooted cat's ears, (*H. radicata*), is very common in meadows in this country, and is liked by cattle. It bears some resemblance to the dandelion.

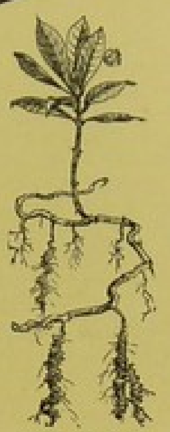
HYPOSTAMINÆ, *hi-pos-tam'-e-ne.*—The name given to that subdivision of *Corallifloræ* in which the stamens are inserted into the thalamus, and do not adhere to the corolla, the ovary being superior.

HYPOTHENUSE, *hi-poth'-e-nuse* (Gr., *hupo,* under; and *teino,* I stretch).—A term denoting the longest side of a right-angled triangle. Euclid, in the 47th proposition of his first book, determines the theory by which the square of the hypothenuse is equal to the sum of the squares of the other two sides of a right-angled triangle, which admirable mathematical problem is said to have been discovered by Pythagoras.

HYPOTHESIS, *hi-poth'-e-sis* (Gr., *hupothesis,* supposition).—A term applied to an argument deduced from an allowed fact. In all mathemetical propositions, in which the manner of reasoning by hypothesis is so vitally necessary, there are two things to be taken into consideration—firstly, the *hypothesis,* and secondly, the *conclusion;* the former being that which is granted, or built on supposition, either of which may be the case, and the latter being the necessary consequence of reasoning from the data. There are no better examples of this form of argument than those found in Euclid's problems, any of which will serve to illustrate the sense in which the word hypothesis is to be understood. For the instruction of the reader, the following will be amply sufficient:—*If two triangles have two sides of the one equal to two sides of the other, and the angles contained by these sides be equal,*



ICHTHYOSAURUS.



IPECACUANHA.

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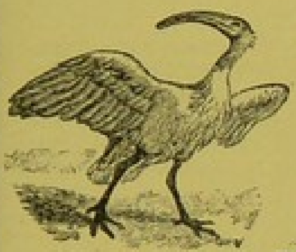
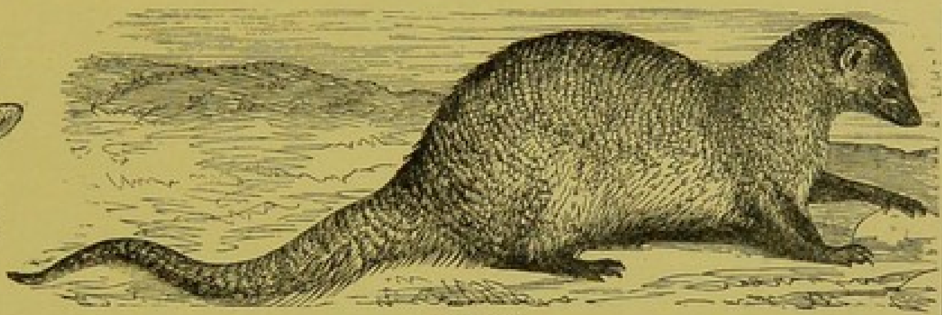
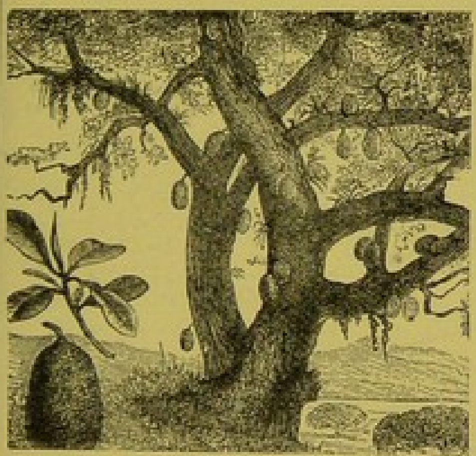


IBIS.

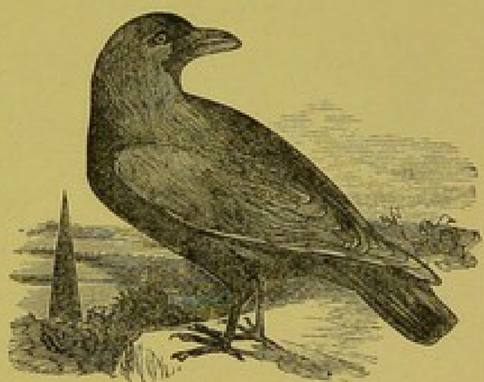


ICHNEUMON.



JAK-TREE.

LAUGHING JACKASS.



JACKDAW.

JAGUAR.

JAY.

then shall the triangles be equal to one another. Now the first part of this proposition, on which it is based, is the *hypothesis*, and the latter part, which is determined by the former, is the *conclusion*. Hypothesis, in fact, is a suggestion founded on probabilities, but the application of which to a particular object must be tested by experiment on exact calculation. In Physics, hypothesis is applied io a free supposition made to simplify or account for many of the phenomena and natural qualities of the world as we see it. Of all hypotheses that have been made, Kepler's, which assumed that all the planets move in elliptic orbits, is one of the most beautiful, as it has been so fully confirmed by after-astronomers and mathematitians, that its truth manifests another strong proof in favour of this mode of argument.

HYPOXIDACEÆ, *hip-oks-e-dai'-se-e* (Gr., *oxus*, sharp).—The *Hypoxis* family, a small, natural order of herbaceous *Monocotyledones*, closely allied to *Amaryllidaceæ*. There are four genera, embracing about 60 species, natives of the warmer regions of the globe. The fleshy roots of some species are eaten.

HYRACOTHERIUM, *hi-ra-ko-the'-re-um.*—The name given by Professor Owen to a genus of fossil *Pachydermata*, fragmentary remains of which have been found in the Lower Eocene strata. Owen supposed the animal to have been herbivorus, and to have had some resemblance to the taper and hydrax. (*See* DAMAN.)

HYSSOP, *his'-sop.*—A genus of plants (*Hyssopus*), of the natural order *Labiatæ*. The Common Hyssop (*H. officinalis*) is a native of Eastern countries and of the south of Europe. It is a half shrubby plant, averaging about 18 inches in height, with evergreen leaves and beautiful blue flowers, and emitting a very agreeable odour. The leaves and young shrubs are sometimes used as a seasoning in cookery; and, when dried, as a medicine, a syrup made from them being a popular remedy for colds. The plant mentioned in several places in the Old and New Testaments as the hyssop was not identical with that which now bears the name, and many varying opinions on the subject have been held. (For Hedge-Hyssop, *see* GRATIOLA).

HYSTERIA, *his-te'-re-a* (Gr., *hustera*, the womb).—A nervous affection to which females are particularly subject, and which is generally connected with uterine irregularities. It occurs most frequently with persons between the ages of fifteen and forty-five or fifty, and is most common with single women of weakly constitution and who lead sedentary lives. This complaint appears in such a variety of forms, and stimulates such a variety of diseases, that it is scarcely possible to give a just character or definition of it. The attack is usually preceded by dejection of spirits, anxiety of mind, difficulty of breathing; a ball is felt advancing upwards from the stomach into the throat, and threatening to stop the passage of the air; then the trunk and limbs of the body become violently convulsed, the patient sobs and cries, and occasionally bursts out into fits of laughter. After a time, these symptoms gradually cease, a quantity of wind is evacuated upwards, with frequent sighing and sobbing, and the woman recovers the exercise of sense and motion without any recollection of what has taken place during the fit—feeling, however, a severe pain in her head and a soreness all over her body. A fit of hysteria may last from a few minutes to several hours, or even days. It is to be distinguished from an epileptic fit by the absence of foaming at the mouth, by the sobbing and crying, by the milder expression of countenance, and by its being gradual, and preceded by the sensation of a ball. Hysteria assumes various other forms, as palpitations of the heart and difficult respiration; pains in different parts, as tbe head, left breast, &c.; different forms of paralytic affections, &c. The hysteric fit, however alarming and dreadful it may appear, is rarely accompanied with danger, and never terminates fatally unless it passes into epilepsy, or the patient be in a very reduced state. During the paroxysm, the first care is to see that the patient do no injury to herself, by striking her head or hands against any hard substance, nor to others by biting. If the fit be slight, it may frequently be arrested by dashing cold water on the face, or by filling the mouth with something of an unpleasant taste, or by applying some stimulating scent to the nostrils. If more serious, the face and neck ought to be freely exposed to the air, the forehead bathed with wet cloths, and a slight purgative administered. In some cases, hysteria is owing to plethora, or fulness of blood, in others to deficiency of it. In the former case, a spare diet, exercise, and occasional purgatives, are recommended, with sometimes the actual abstraction of blood; in the other case, the system is to be kept up and sustained by nourishing diet and tonics, particularly iron. The patient's mind is to be kept as cheerful and tranquil as possible, by agreeable company; and all tendency to excesses or irregularities kept in check. After the fit is over, a strong dose of aperient medicine should be administered.

HYSTRIX, *his'-triks.* (*See* PORCUPINE.)

I.

IBERIS, *i-be'-ris.* (*See* CANDYTUFT.)

IBEX, *i'-beks* (Lat., *Capra Ibex*), an animal belonging to the family of the *Capridæ*, its characteristics are similar to others of the Capridæ, and will be found given under the article GOAT. The ibex is sometimes termed the *steinbok*, and is found principally inhabiting the Alps, the Carpathian mountains, and the Pyrenees, in Europe, of which continent it is a native. Its horns are extremely long, and are very large. Their colour is a deep brown, and they are marked on the upper surface with protuberant transverse rings or half-circles. The nature of the ibex is gregarious, and, consequently, it is always met with in small flocks; and the animal is likewise remarkably swift, and able to climb the highest mountains and most precipitous ascents; the pursuit of the ibex is extremely difficult and hazardous.

IBIS, *i'-bis*, a genus of grallatory birds, common throughout Africa, one of whose most remarkable species is the (*Ibis religiosa*). This latter variety arrives in Egypt about the time that the inundations of the Nile commence, and it emigrates from thence into Ethiopia about June, when the waters have subsided. It is about the size of a fowl, the head and neck being bare and the body white, while the long quills of the wings are tipped with shining ashy black. It was worshipped by the ancient Egyptians, who considered it a sacred bird, and mummies of it are being continually discovered in large numbers in the catacombs of Memphis. The principal other variety is the glossy ibis (*Ibis falcinellus*), which is nearly two feet in length, and proportionate in size.

ICACINACEÆ *i-ka-sin-ai'-se-e.*—The *Icacina* family, a natural order of *Dicotyledones*, in the sub-class *Thalamifloræ*, consisting of evergreen trees and shrubs, natives of tropical and nearly tropical countries. This order was formerly included in *Olacaceæ*.

ICE, *ise*, the familiar and also the technical term for water in the solid state. Water on being cooled, contracts until the temperature has fallen to about 39° Fah., when it begins to expand. At the freezing point 32°, under ordinary circumstances, ice is formed, which, in consequence of the continued expansion, has only 0·93 the density of water at 39°. The ice, therefore, floats upon the surface. The increase of volume in the formation of ice is the cause of the splitting of stones and rocks by the frost; for water penetrates into the crevices, and there becomes frozen. The great expansive force of ice was experimentally investigated by Major Williams. He filled a mortar with water, and having rammed a wooden plug tightly into the muzzle, placed it in air at a temperature considerably below freezing-point. When the water froze, the plug was forcibly driven out to a distance of 400 feet. We have a familiar instance of the same power in the bursting of water-pipes in very cold weather. Salt water freezes at a lower temperature than fresh water. Immense quantities of ice, in large blocks, are imported into this country from North America and Norway, for the purposes of cooling and preserving wines and provisions, and for use in confectionary. The blocks are covered with sawdust, straw and charcoal dust, all non-conductors of heat. The first cargo of American ice consigned to this country was in 1806. Ice has the peculiar property of reuniting by the contact of adjoining surfaces, after having been broken into fragments. (*See* REGULATION.) The phenomena attending the conversion of water into ice are noticed under the heads FREEZING, LATENT HEAT, TEMPERATURE, and WATER.

Iceberg, *ise'-berg* Ger., *eis*, ice; *berg*, mountain).—The name given to a mountainous mass of ice floating in the sea. Some icebergs are formed by the accumulation of ice and snow on the surface of the water; others are produced by the descent of glaciers into the sea. When numbers of icebergs freeze together, they form what are called "fields" or "packs," which are often of great extent, stretching across the ocean as far as the eye can reach, and often rising in perpendicular cliffs from 80 to 100 feet above the water. Solitary icebergs are also often of vast dimensions, and instances are given, both in Arctic and Antarctic voyages, of floating islands of ice several miles in circumference, rising from 40 to 200 feet above the sea-level, and loaded with blocks and shingle. As they are floated by the polar currents to warmer latitudes, they melt away, dropping their burdens of boulder and rock debris on the bottom of the ocean. Geologists regard the water-worn blocks, the gravel, and shingle of the "boulder-clay" as the deposits of ancient icebergs.

Ice-Blink.—A name given by seamen to a luminous appearance seen near the horizon in northern latitudes. It is caused by the light being reflected by the fields of ice, and it is seen long before the ice itself which causes it can be observed.

ICE-SPAR.—This name is applied to transparent crystals of felspar found in certain lavas.

ICELAND SPAR is a transparent crystalline calc-spar, possessing the property of densely refracting objects seen through its masses. This spar was first found in Iceland, whence the name.

ICE-PLANTS.—An annual herbaceous plant (*Mesembryanthemum crystallinum*), named from its appearance, not from the places where it is found, it being a native of Africa and the South of Europe. It is covered with small watery vesicles, having the appearance of gramiles of ice, and sparkling in the sun. It is cultivated in this country in greenhouses. In the Madeira islands, the seeds are eaten; and in places where it is plentiful, the plant is burned on account of the barilla found in the ashes. (*See* BARILLA and MESEMBRYANTHEMUM.)

ICELAND MOSS. (*See* CETRARIA.)

ICHNEUMON, *ik-nu'-mon* (Gr., *ichneumon*, from *ichneuo*, I track; probably because it tracks the footsteps of the crocodile).—A name applied to a genus of quadrupeds, otherwise known as *Herpestes*. The genus has the following characters:—feet short, with five demi-palmated toes, armed with claws, which are slightly retractile; tongue furnished with horny papillæ; ears small; body very much elongated, with a long tail, strong at the base. The species of the genus *Herpestes* are found in the warmer parts of Asia and Africa. The *Ichneumon*, or *I. Pharaonis*, has fur of a chestnut-brown and yellow colour, each hair being annulated with those two colours; the feet and muzzle are black, or deep chestnut, and the tail is terminated by a tuft of long hair. It appears to have been one of the sacred animals of the ancient Egyptians; and, according to Herodotus, it was buried in "holy repositories." Although many fabulous feats performed by this animal, in destroying crocodiles, are narrated by ancient writers, they would all appear to be founded upon its industrious searching for the eggs of that reptile. The ichneumon, however, preys upon the eggs of other animals besides those of crocodiles. In Upper and Lower Egypt, during the inundations of the Nile, it is frequently found in gardens and near the villages; but in the dry season it resorts to the open felds and to the banks of the river. It feeds on plants, eggs, and fowls, killing the latter in the villages at night. The ichneumon can be easily tamed, and taught to go about a house like a cat. It makes a growling noise, and barks when angry. The Indian margouste, or mungus, a grey ichneumon (*H. griseus*), has been known to kill twelve full-grown rats, which were let loose in a room sixteen feet square, in less than a minute and a half. It also destroys small reptiles.

ICHNEUMON FLY.—The genus of insects called ichneumon belong to the order *Hymenoptera*, section *Terebrantia*. The species are very numerous, more than 1,600 being found in Europe, and they are scattered over most parts of the world. Some are very minute and others among the largest of insects. They are remarkable for the habits of their larvæ, which are parasitic in the bodies of other insects. The perfect ichneumons perforate these bodies by means of their ovipositors, and there deposit their eggs. They have derived their name from this destructive habit, a comparison having been drawn between them and the *Herpestes Ichneumon*, the quadruped above described. The fully-developed insect feeds only on the juices of flowers.

ICHNITES, *ik'-nites* (Gr., *ichnos*, a footprint), in Geology, a term applied to all fossil footprints.

ICHOR, *ik'-or* (Gr.).—A thin, acrid, and sanious discharge from wounds, ulcers, &c.

ICHTHIN, *ik'-thin*,—The azotized albuminoid principle obtained from the yolk of the eggs of fishes.

ICHTHYODORULITE, *ik-the-o-dor'-u-lite* (Gr., *ichthus*, fish; *doru*, spear; *lithos*, stone).—A fossil fin-spine. The spines of certain shark-like fishes of the lower coal-measures are often more than a foot long, and exceedingly strong.

ICHTHYOLITE, *ik'-the-o-lite* (Gr., *ichthus*, fish; *lithos*, stone), in Geology, a general term for a fossil fish, or any portion of a fish; as a scale, tooth, or spine.

ICHTHYOLOGY, *ik-the-ol'-o-je* (Greek, *ichthus*, a fish; *logos*, a discourse), that branch of science which treats of the natural history of fishes. For a general description of the features and anatomy of these many-formed animals, the reader is referred to a former article. (*See* FISH.) The science of ichthyology, during many remote ages, consisted, in common with all similar branches of human knowledge, of merely a few partial, unconnected observations. No real advance was made till the middle of the 16th century, when Belon, Rondelet, and Salviani, the true founders of modern ichthyology, made their appearance. These men, instead of merely compiling, like their predecessors, saw and examined for themselves, and made drawings from nature. About the end of the 17th century, Willoughby, and the celebrated John Ray, first issued a history of fishes, in which the species were not only accurately described from nature, but distributed in accordance with characters drawn solely from their structure. Finally, Artedi and Linnæus, about the middle of the 18th century, completed the work which the others had commenced, by establishing well-defined generic groups, consisting of species, well ascertained and accurately characterized. The science made a great stride since that time, owing to the zeal, accuracy, and perseverance of Baron Cuvier, whose great work—"Histoire Naturelle des Poissons," treats comprehensively of the subject; and Agassiz, Owen, and other eminent naturalists, have since his time contributed largely to our knowledge of the subject. In the lowest known form of fish, the lancelet, the whole vertebral column is merely a pulpy, nervous chord, invested by a membranous sheath. Instead of limbs, fishes have fins, the anterior being named the pectoral fins, and the posterior the dorsal fins. The vertical fins are of a different nature. Artedi denominated those fishes which have spinous rays on the back, Acanthopterygians (Gr., *acantha*, a thorn; *pteryx*, a wing), and those which have only flexible and jointed rays, Malacopterygians (Gr., *malakos*, soft; *pteryx*, a wing). According to Cuvier, the acanthopterygian character assumes a preponderance over all other divisions, and renders them secondary, and incapable of being placed in opposition to it. The malacopterygian families are distinguished by more marked differences and characters than the former; some are both naturally and distinctly limited, so that each is not only clearly separated from the other, but also retains within itself a great resemblance in the details. The history of fishes commences with the acanthopterygians, which constitute one immense family. Amongst them are many varieties, useful as articles of food, and of considerable value to man in a commercial point of view. The malacopterygians include the abdominal fishes, which have the ventral fins situated behind the pectoral. These are mostly fresh-water fishes, such as the carp, pike, and salmon: the herrings are also of the same nature. The sub-brachial and apodal fishes have cartilaginous fins.

Classification of Fishes.—One of the modern classifications of fishes is that of Professor Müller, who finds characters which he considers to be of the highest importance in the vascular system. There is in most fishes, close to the ventricle, a thick muscular swelling of the commencement of the arterial system, which might almost be called a third chamber of the heart. The blood is prevented from regurgitating into the ventricle, on the contraction of this bulb, by valves. The number of these openings, and the presence or absence of the thick muscular coating of the bulb, furnish distinct characters for the different groups. Müller says that these characters are so constant that he is unacquainted with any others, either anatomical or zoological, equal to them in certainty. The *Plagiostomi*, or cartilaginous fishes, have three or more rows of valves within the muscular valve. In the *Ganoids*, a still greater number is present; but in the large group formed by the osseous fishes, after the ganoids have been removed from them, there are only *two opposite valves* at the origin of the bulb. This large group of perfect osseous fishes Müller names *Teleostei*. Altogether he makes six sub-classes of fish:—*Teleostei*, *Dipnoi*, *Ganoidei*, *Elasmobranchii*, *Marsipobranchii* or *Cyclostomi*, and *Leptocardii*. In Professor Owen's modification of this arrangement, these sub-classes are not preserved, the class being subdivided into the following eleven orders, and again into sub-orders. (*See* various headings.) The orders are:—1. Dermopterous fishes; 2. Malacopterous fishes; 3. Pharyngognochs; 4. Anacauths; 5. Acanthopterous fishes; 6. Plectognathus fishes; 7. Lophobranchs; 8. Ganoids; 9. Sirenoids; 10. Chondropterygians; 11. Plagiostomic fishes.

ICHTHYOSAURUS (Gr., *ichthus*, fish; *sauros*, lizard), a well-known genus of extinct marine saurians, so called from the combination of fish and lizard characters. The great era of ichthyosauric development was from the middle Trias to the Chalk inclusive, the Lias formation being the chief repository of their remains in England. In this deposit specimens of all ages and of all sizes have been found—from the fœtus of a few inches to the adult more than thirty feet in length. About 30 species are known. The following are the most striking peculiarities in the structure of the fish-lizard:—The vertebræ resemble those of fishes in being concave at each end. The cranium resembles that of the crocodile, but is characterized by a remarkably large eye-orbit, furnished with a circular series of bony sclerotic plates—a structure observable in the eyes of turtles, lizards, and many birds. The teeth, which are extremely numerous, resemble in structure those of the crocodiles, but are implanted in a deep continuous groove, and not in distinct sockets. The locomotive extremities are similar to the paddles of the whale; but they are four, instead of two, in number. From the form and position of masses of crushed and apparently half-digested fish-bones and scales in the abdominal cavity, it is concluded that the ichthyosaurs preyed upon fish; and from the shape of their *coprolites*, or fossil excrements, it is obvious that their intestinal canals were furnished with spiral valves, as in the sharks. In one or two instances, very small, and to all appearance fœtal, specimens have been found within the pelvic cavities of large ichthyosauri; and from this circumstance it has been inferred that these extraordinary creatures, like the whales, were viviparous.

ICHTHYOSIS, *ik-the-o-'sis* (Gr., *ichthus*, a fish), a disease of the skin, which takes its name from the surface of the cuticle suggesting the idea of the scaly skin of a serpent or fish. It is generally confined to patches in the armpits and on the breast or chest; but sometimes it attacks the face. Warm and vapour baths are among the remedies employed.

ICHTYHS, *ik'-this* (Gr., *ichthus*, a fish), a word found on many ancient tombstones, urns, seals, rings, &c., belonging to the early ages of Christianity. As each character forms an initial letter in the Greek words *Iseous Christos, Theou Uios Soter* (Jesus Christ, the Son of God, the Saviour), the word is supposed to have had a mystical meaning. It would appear as if this interpretation were correct, when the reverence with which the fish was symbolically regarded by the ancients is considered.

ICICLE, *i'-sik-kl* (Sax., *ises-geal*), a pendent conical mass of ice, formed by the freezing of water or other fluid as it flows down an inclined plane, or collects in drop and is suspended. In the north of England it is called *ickle*.

ICOSAHEDRON, *i-ko-sa-he'-dron* (from Gr., *eikosi*, twenty, and *hedra*, base), one of the five regular solids, according to the Platonic theory, and composed of equilateral and equal triangles. As it is composed, therefore, of twenty equal and similar pyramids, whose vertices all meet in the same point, the content of one of these multiplied by twenty will give the whole content of the icosahedron. (*See* GEOMETRY.)

IDE, *ide*.—A fish (*Lenciscus Idus*) of the family *Cyprinidæ*, belonging to the same genus as roach, dace, and club. It is a native of the lakes of the northern parts of Europe, and ascends rivers to spawn.

IDIOCY, *id'-e-o-se*.—The state of non-development of the mental powers. The difference between idiocy and insanity is, that the one implies deficiency, the other marked condition. The degrees of idiocy are many. In some cases there is more innocent imbecility ("innocent" is a frequent name for idiot in some parts of the country); in others, degraded propensities, inability to regulate movements, to articulate clearly, and an almost total absence of intellectual power. The face is generally distorted, and the manner grotesque. The first attempt to educate idiots was at the Bicêtre at Paris. In this country there is a noble establishment at Earlswood in Surrey (begun 1847), another at Calabaur (1869), and there are institutions of the same kind at Larbert, Stirlingshire, and at Balderan, Forfarshire.

IDIOPATHIC, *id-e-o-path'-ik* (Gr., *idios*, one's own; *pathos*, an affection), a term applied to a disease which is not dependent on any other complaint, and therefore opposed to those diseases called symptomatic.

IDIOSYNCRASY, *id-e-o-sin-kras'-se* (Gr., *idios*, proper; *sun*, with; *krasis*, temperament), peculiar temperament of mind or of body; a state of constitution peculiarly susceptible to be affected by certain agents, which in general produce no effect upon others. In this way, some persons are violently affected by honey, coffee, butter, &c. What are commonly called antipathies belong to this class. (*See* ANTIPATHY.)

IDOCRASE, *id'-o-krais* (Gr., *idea*, form; *krasis*, mixture).—A variety of the garnet, known also as the Vesuvian or pyramidal garnet. It was originally found in the ejected calcareous matter on Vesuvius, but it also occurs in the primitive rocks. There are two principal varieties—the purple or violet, known as *hyacinth*, and the green, *chrysolite*.

IGNATIA, *ig-nai'-she-a*.—A genus of the natural order *Loganiaceæ*. The species *I. andra* yields the seeds known as St. Ignatius's beans. They are intensely bitter, and contain the alkaloid strychnia in even larger proportions than the nux vomica seeds.

IGNEOUS ROCKS, *ig'-ne-ous* (Lat., *ignis*, fire). (*See* GEOLOGY.)

IGNIS FATUUS, *ig'-nis fat'-u-us* (Lat., literally "the foolish fire"), a term applied to a sort of luminous meteor which flits about in the air a little above the level of the ground, and which appears generally in marshy places, in churchyards, and near stagnant waters, during the nights in summer. It is called in different country places in England by the names of "Jack o' Lantern," or "Will o' the Wisp;" the people ascribing its appearance to the agency of evil spirits. The cause of the phenomenon has not been satisfactorily ascertained. It has been attributed to phosphuretted hydrogen gas, and also to light carburetted hydrogen gas; but attempts to reproduce it artificially have failed. Probably various phenomena similar to the eye, but arising from different causes, are popularly classed under the same name.

IGNITION. (*See* INCANDESCENCE.)

IGUANA, *ig-u-an'-na*.—The type of the *Iguanidæ*, a family of Saurian reptiles, forming, along with the *Agauridæ*, the tribe *Strobilosaura*. The principal characteristics of the *iguana* are as follows:—A large thin fold of skin, or dewlap, under the chin; cephalic cuticular plates; a double row of small palatal teeth; maxillary teeth with their edges finely dentilated: a crest on the back and tail; toes long and unequal; tail very long, slender, and compressed, and covered with small scales. It is a very nimble reptile generally, and lives in warm climates. Some of the species live upon vegetables, and others upon animal food. It particularly inhabits South America and the West Indies, where it is very numerous. From its cleanly habits and delicate flesh, it is esteemed a great dainty, and tastes very like chicken. It lives for the most part on trees; but when forced to take the water, it can swim very readily. The common iguana, or *Iguana tuberculata* is about five feet in length, although many exceed that. It is of a more or less green colour throughout, and its dewlap is of a bright yellow colour, as is also the crest which runs along the back. They are thought to be best fit for eating in the spring, when they are sought and hunted with great avidity. Although in reality very timid animals, they have a very formidable appearance, which is contradicted by their harmless habits and endeavours always to escape when pursued. The female deposits her eggs in the sand, where they are hatched by the warmth of the sun.

IGUANODON, *ig-u-an'-o-don* (*iguana*, and Gr., *odous*, a tooth).—An extinct genus of gigantic reptiles, discovered by Dr. Mantell, and named by him on account of the resemblance of their teeth to those of the iguana. The size to which these reptiles attained in former ages must have been enormous. It is calculated that the thigh-bone of the iguanodon exceeded in bulk that of the largest elephant, and its length is estimated to have been from four to five feet. After comparing the bones of the iguanodon with those of the iguana, and taking an average from eight separate parts of the respective skeletons, Dr. Mantell gives the following as the dimensions of this giant:—Length from snout to extremity of tail, 70 feet; length of tail, 52½ feet; circumference of body, 14½ feet. The limbs were long and strong, raising the body some distance from the ground. On the snout of the iguanodon was a horn; and the general appearance of the reptile must have fully realized the wildest ideas of the dragons of poetic lore. Professor Owen does not think that the iguanodon was so large an animal as Dr. Mantell infers, but believes that it was about thirty feet in length. It appears probable that the most formidable instrument of attack and defence possessed by this reptile was its long and powerful tail. The fossils are abundant in the Wealden beds of Kent, Sussex, and the Isle of Wight.

ILEUM, *il'-e-um* (Gr., *eileo*, I turn about, from its numerous convolutions).—The last portion of the small intestines, which terminate at the value of the cæcum.

ILEUS, OR ILIAC PASSION, *il'-e-us*, *il'-e-ak* (Lat., *iliaca passio*).—A severe intestinal disease, characterized by violent griping pain, accompanied with retraction and spasms of the abdominal muscles, costiveness, and vomiting of fæcal matter. It arises from many causes, and is generally symptomatic of some other disease. Among the most frequent causes of this disease are strangulated hernia, intus-susception, or the retention of one part of the bowel within another, unnatural adhesions between adjacent folds of the intestines, inflammation, &c. Dry and humid fomentations, warm baths, and warm and copious glysters, afford the most reasonable chance of effective relief.

ILEX, *i'-leks*, the Holly, a genus of the natural order *Aquafoliaceæ*. The species *I. Aquifolium* is one of our most beautiful shrubs or low trees, displaying either character, according to situation, age, and application of art. It is found in most parts of Europe, and in North America, Japan, and Cochin-China. In Britain it is found in natural woods and forests, sometimes forming extensive assemblages of fine trees. By culture, more than a hundred varieties and sub-varieties have been developed, differing in the variegation, margin, and size of the leaves, and in the colour of the fruit. The common green prickly-leaved holly makes the best of all hedges. (*See* HEDGE.) The custom of dividing gardens by trimly-shorn hedges of holly was very general about the end of the 17th century. Evelyn's impenetrable holly hedge at Deptford has been much celebrated: it was 400 feet long, 9 feet high, and 5 feet broad. The deep shining green leaves and beautiful coral berries of the holly are essential elements in the domestic decorations with which Christmas is honoured. Not merely as an ornamental evergreen is the holly noticeable. Its white wood is extremely hard, and is used by cabinetmakers for inlaying, and to some extent by engravers. From its inner bark birdlime is prepared. The leaves have been employed in intermittent fevers. The berries are purgative and emetic. The North American species, *I. vomitoria*, has bitter leaves, of which the Creek Indians make a decoction which they use as an emetic, under the name of *black drink*. The leaves and young twigs of *I. Paraguayensis*, the Brazilian or Paraguay holly, are extensively employed in South America as tea, under the name of *maté* or *Paraguay tea*. It is remarkable that *maté* contains *caffeine*, the principle existing in coffee and Chinese tea. It has somewhat similar properties to those of Chinese tea; but it is more exciting, und, when taken to excess, produces a kind of intoxication. Another *maté*, called *gongonha*, is prepared in Brazil from the species *I. gongonha* and *theezans*. The fresh leaves of the South-American hollies have great astringency, and on this account they are much used by the dyers of Brazil.

ILLICIUM, *il-lish'-e-um* (Lat., *illicio*, I allure, from having a most agreeable perfume). A genus of plants remarkable for the fragrance and beauty of their flowers and foliage, belonging to the natural order *Magnoliaceæ*. The species *I. anisatum*, or star-anise, has the odour and flavour of aniseed. They have all laurel-like leaves. The fruit is used by the Chinese as an aromatic and carminative, and as a spice. The oil obtained from the seeds is said to be substituted occasionally for oil of anise. Two species, natives of Florida (the *I. floridanum* and *I. parviflorum*), are fragrant and beautiful.

IMAGE, in Optics, is the spectrum, or appearance of an object made by reflexion or refraction.

IMAGINARY QUANTITIES, *im-aj'-e-na-re*.—A term applied in Algebra to the even roots of negative quantities, or the imaginary results of some impossible operation. In *arithmetic*, considered without reference to its *applications*, every *inverse* operation implies the previous performance of the corresponding *direct* operation; and therefore *surd* quantities, whereof the arithmetical values can never be *exactly* ascertained, have their origin in the application of arithmetic to geometry. Although imaginary quantities have no real value, yet they are of important aid in the higher parts of mathematical analysis, as they indicate a marked distinction between quantities which have no natural or necessary dependence on each other.

IMIDES, *i'-midez*, in Chemistry, a class of bodies intermediate between the amides and nitrites, supposed to contain a hypothetical radicle, imidogen, or ammonia, less two equivalents of hydrogen. (*See* ORGANIC BASES.)

IMITATIVE INSANITY.—The morbid exhibition of the natural tendency to copy what exercises a strong influence on the imagination. When a great crime has been committed, it is frequently followed by others, apparently motiveless, of a similar kind.

IMMERSION, *im-mer'-shun* (Lat., from *in*, into, and *mersus*, part. of *mergere*, to plunge).—The disappearance of one heavenly body behind another, or within the shadow cast by another during an eclipse. Immersion, or incidence of an eclipse, takes place as soon as the disc of the body that is eclipsed begins to pass behind the disc or shadow of the other.

IMPACT, *im'-packt* (from Lat., *impingo*, I impinge).—The single instantaneous blow or stroke communicated from one body in motion to another body, which may be either in motion or at rest. If the body moves in the direction of the stroke, the impact is said to be direct; if in a different direction, it is said to be oblique.

IMPATIENS, *im-pai'-shens.*—A genus of the natural order *Balsaminaceæ*. The species *I. balsamina* is commonly known as the Balsam, and is one of the most beautiful of garden annuals, forming a showy cone of finely-variegated carnation-like flowers. Those are regarded as the most choice varieties which have the flowers double and striped; but none of the varieties are permanent, or can be continued by seeds. The prevailing colours of the petals are white and red, the latter extending to every shade of orange, scarlet, purple, lilac, pink, and especially carnation or flesh-colour. The way to procure very large plants is to sow early in the season, as in March; to commence transplanting into three-inch pots, as soon as the plants have two proper leaves; and to shift every week or ten days into pots a size larger every time, until at last they are in very capacious ones, and in the richest light mould. *I. nolitangere*, the touch-me-not, is the only species found wild in Europe. When the seeds are ripe, the slightest touch will cause the capsule to burst with elastic force; hence the names *impatiens* and *nolitangere*.

IMPENETRABILITY, *im-pen-e-tra-bil'-e-te* (from Lat., *impenetrabilis*, impenetrable).—A term applied to one of the properties of matter, inferred by experience, and resting on the fact that, at the same instant of time, no two bodies can occupy the same portion of space. As regards solid bodies, the property requires no proof. The property can also be proved for liquids by very simple experiments. If a solid body is immersed in a vessel brimful of water, it will displace a quantity of water equal to its own bulk; and if a cork be forcibly pressed into the neck of a bottle full of water, the bottle will burst. The lightest gases are as impenetrable as the densest solid, although, owing to their compressibility, it is not so apparent. Sugar or salt may be dissolved in water without increasing the bulk of the fluid; but in that case the introduced matter probably takes the place of air which it expels.

IMPERFECT NUMBER, *im-per'-fekt* (Lat., *imperfectus*).—A number, the sum of whose aliquot parts or divisions is not equal to itself. Thus 12 is an imperfect number, for example, as its divisors, 1, 2, 3, 4, 6, amount to 16, which is over 12, which latter number is therefore deemed imperfect. (*See* NUMBERS, PROPERTIES OF.)

IMPERMEABILITY, *im-per-me-a-bil'-e-te* (Lat., *in*, not; *permeo*, I pass), a term applied to that property by which some substances resist the passage of other substances through their mass. Thus glass is impermeable, for its pores are so small that no pressure hitherto applied has been able to drive fluids through them. Some substances are impermeable on account of their repulsion to other bodies; thus, oil-skin or waterproof cloth, is impermeable to water.

IMPETIGO, *im-pet-i'-go* (Lat., from *impetire*, to infest)—An eruption of yellow itching pustules, appearing in clusters, and terminating in a yellow, thin, scaly crust. It is also known as humid or moist tetter, and passes a thin acrid discharge. It occurs on all parts of the body, but most commonly on the extremities. A variety of it is produced by the action of certain irritants upon the skin, as on the hands of those who work among sugar, known as the grocer's itch; also on the hands of bricklayers, known as the bricklayer's itch. The eruption is not contagious. Cleanliness, mild aperients, and lotions of oxide, of zinc, and rose-water, are recommended by way of cure.

IMPETUS, *im'-pe-tus* (Lat.).—A term which signifies the same thing as *momentum*, or quantity of motion; and is generally estimated by the product of the velocity and mass of the body. In Gunnery, *impetus* is the altitude through which a body must fall in order to gain a velocity equal to that with which the ball is discharged from the gun.

IMPEYAN PHEASANT, *im'-pe-an fez'-zant.*—A large gallinaceous bird (*Lodophorus Impeyanus*), a native of the elevated regions of the Himalayas. It is of large size, and the male has splendid plumage, showing changing metallic tints. The Nepaulese name it *Monaul*, or bird of gold. The name given above was taken from Lady Impey, who unsuccessfully tried to bring a live specimen to this country.

IMPREGNATION. (*See* REPRODUCTION OF PLANTS AND ANIMALS.)

IMPULSE, *im'-puls* (Lat., *impulsus*), the force of one body communicated to another in a continuance of motion after the force has been withdrawn. When a body is violently struck, as in the case of a ball by a cricket-bat, no gradations of velocity are seen; but the ball appears to change from a point of rest, as it were, to a state of rapid motion. Impulse may, therefore, be said to be any cause by which velocity is communicated suddenly and without gradations.

INCANDESCENCE, *in-kan-des'-ens* (Lat., *incandescens*).—The luminous glow given by a substance when intensely ignited. Ignition and incandescence are properties belonging to some bodies, by which they give out light when raised to certain high temperatures, the quantity of light increasing with the temperature. The light at first is of a dull-red, then bright, and indicating what is called cherry-red heat: it becomes orange-coloured or yellow at a higher temperature; and, lastly, a white heat, when the light becomes painful to the eye. A dull-red heat, visible at daylight, is probably about 1,000°; a cherry-red heat, 1,200°; an orange-heat, 1,700°; and a white-heat, 3,000°.

INCIDENCE, ANGLE OF *in'-se-dens* (Lat., *incido*, I fall upon).—(*See* CATOPRICS and OPTICS.)

INCISORS, *in-si'-zorz* (Lat., *incisores*, fr., *incido*, I cut).—The four front teeth in each jaw so called from their use in cutting the food.

INCLINATION, *in-klin-ai'-shun* (Lat., *inclinatio*), a term used to express the angle which two lines or planes make with each other. Thus, two lines which make a very small angle are said to have a very small inclination to one another.

INCLINED PLANE, *in-klined' plain.*—One of the five simple mechanical powers in statics, the theory of which can be easily deduced from the proposition termed "the decomposition of forces." If a body be placed on a horizontal plane on which there is no friction, it stands to reason that the body will be entirely supported, and that horizontal pressure will cause motion. If the same plane be made vertical instead of horizontal, the weight cannot be placed upon it; for if the heavy body were made to touch the plane and then left to itself, it would fall down the plane, exactly in the same manner as it would fall if there were no plane; that is, if it be supposed that no friction exist. It follows, consequently, that if the plane be made to assume an oblique or inclined position, the effect produced will be intermediate between those of the two preceding cases; for the weight will not rest, nor will it acquire velocity as rapidly as when it falls freely. The inclined plane, then, is a plane which forms an angle with the horizon. The force which accelerates the motion of a heavy body on an inclined plane is to the force of gravity as the sine of the inclination of the plane to the radius, or as the height of the plane to its length. The motion of a body on an inclined plane is accelerated in a uniform manner. If two bodies begin to descend from rest, and from the same point, the one on an inclined plane and the other falling freely to the ground, their velocities, at equal heights above the earth's surface, will be equal. Hence the velocity acquired by a body in falling from a rest through a given height is the same, whether it fall freely or descend on a plane with any inclination whatever. When a power acts on a body on an inclined plane, so as to keep that body at rest, then the weight, the power, and the pressure on the plane will be as to the length, the height, and the base of the plane, when the power acts parallel to the inclined surface. A man can raise a barrel which he could not lift by rolling it up an inclined plane, because his strength has to overcome the tendency to descend and the force of friction, and not the dead weight of the barrel. (*See* STATICS.)

INCOMMENSURABLE QUANTITIES, *in-kom-men'-su-ra-bl*, are those which are so related that, while one is a multiple of a certain unit, the other is not.

INCREMENT, *in'-kre-ment* (Lat., *incrementum*).—A term used in the calculus to express the increase in the function of any quantity by an infinitely small quantity, in opposition to *decrement*, which is of directly the reverse signification.

INCUBUS, OR NIGHTMARE, *in'-ku-bus* (Lat., from *incubo*, I lie upon).—A distressing sensation sometimes experienced during sleep, and usually accompanied by frightful dreams. The patient is pursued by some enemy or wild beast, or endeavours to escape from some danger, but cannot; there is a dreadful weight upon his chest; he strives to cry out, but is unable; at length he awakes in terror, and feels great relief. Nightmare is most frequently caused by a heavy supper just before going to bed: dyspepsia, mental irritation, great fatigue, lying in an uneasy position, may all occasion it. The cure is avoidance of these causes and attention to the state of the stomach.

INDEHISCENT, *in-de-his'-sent* (Lat., *in*, not, and *dehisco*, I gape).—A term applied to a fruit, the pericarp of which continues perfectly closed, as in the hazel-nut. When it separates regularly round its axis, either wholly or partially, into several pieces, the separation is called *dehiscence*, and such pieces *valves*; and the axis from which the valves separate, when there is a distinct axis, is called the *columella*.

INDETERMINATE COEFFICIENTS, *in-de-ter'-min-ait*, a form of analysis said to have been invented by Descartes, which is much used, even in the highest branches of mathemathics. The system is based on the following formula:—If $A+Bx+Cx^2+$ &c. $=a+bx+cx^2+$ &c., be an identical equation, that is, if it hold for all values whatever of x, then the coefficients of like powers of x are equal to each other; that is, if $A=a$, $B=b$, $C=c$; and so on. For if $A+Bx=a+bx$, then $A-a+(B-b)x=O$, an equation which admits of one value of x only; unless $B-b=O$, or $B=b$, when also $A-1$ will be$=O$, or $A=a$. Again, if $A+Bx+Cx^2=a+bx+cx^2$, then $A-a+(B-b)x+(C-c)x^2=O$, a quadratic equation which admits of but two solutions to the distinct values of x. The application of indeterminate coefficients thus enables the student to solve qnestions by ordinary algebra that would otherwise come under what is termed infinitesimal analysis. (*See* FLUXIONS and INTEGRAL CALCULUS.)

INDETERMINATE EQUATIONS.—A mathematical term applied to problems which are capable of more than one solution, in consequence of there being more unknown quantities than independent equations. The rule for solving these may be thus given:—If a simple equation express the relations of two unknown quantities, and their corresponding integral values be required, divide the whole equation by the coefficient which is the lesser of the two, and suppose that part of the result which is in a fractional form equal to some whole number; thus a new simple equation is obtained with which we can proceed as before. Let the operation be continued until the coefficient of one of the unknown quantities is 1, and the coefficient of the other a whole number; then an integral value of the former may be obtained by substituting O, or any whole number, for the other; and from the preceding equations integral values of the original unknown quantities may be found. Converging fractions and other theories are connected with that of indeterminate equations.

INDEX, *in'-deks.*—In Arithmetic and Algebra, Index is a term used to imply the power to which a number or quantity is to be raised. (*See* INVOLUTION.)

INDIAN BAEL. (*See* ÆGLE.)

Indian Bread. (*See* PACHYMA.)
Indian Corn. (*See* ZEA.)
Indian Cress. (*See* TROPÆOLUM.)
Indian Fig. (*See* OPUNTIA.)
Indian Fig-tree. (*See* FICUS.)
Indian Fire, a bright white fire, used in pyrotechny,

composed of—sulphur 7 parts, realgar 2 parts, and nitre 24 parts.

Indian Hemp. (*See* CANNABIS.)
Indian Millet. (*See* PANICUM.)
Indian Sarsaparilla. (*See* HEMIDESMUS.)
Indian Teak. (*See* TECTONA.)
Indian Tobacco. (*See* LOBELIA.)
India-Rubber. (*See* CAOUTCHOUC.)

INDIAN SHOT.—A plant (*Canna Indian*) growing in tropical countries, belonging to the natural order *Marantaceæ*. (*See* CANNA.) The hard, round seeds are sometimes used as shot. In Brazil, poultices are made from the root-stock.

INDIVISIBLES, *in-de-viz'-e-bls*.—A peculiar method of the calculus invented by Cavalieri, a disciple of Galileo, which was much used by mathematicans before the invention of fluxions and the differential and integral calculus. In this theory, lines are considered to be composed of an infinite series of points, surfaces, of an infinite number of lines, and solids of an infinite number of surfaces. The purpose, therefore, of the method is to give an infinite series of successive approximations, and it is extremly useful in discovering the contents and areas of innumerable plane and solid figures. (*See* FLUXIONS, INTEGRAL CALCULUS.)

INDUS, *in'-dus* (Lat., *indus*, an Indian), a constellation of the southern hemisphere. It lies to the south of Sagittarius, being between that constellation and the South Pole. It was formed and named by Bayer. Its largest star is one of the third magnitude.

INDUSIAL LIMESTONE, *in-du'-se-al*.—A variety of fresh-water limestone, formed of the fossilized coverings of caddis-worms, encrusted with carbonate of lime. It is found in Auvergne in France, in beds, in some instances, six feet thick.

INERTIA, *in-er'-she-a* (Lat., inactivity).—That property of matter by which it would always continue in the same state of rest or motion in which it was put unless changed by some external force. Kepler conceived this as indicating a degree of power, and termed it *vis inertiæ*. Inertia is the principal law of the material world. All bodies are absolutely passive, or indifferent to a state of rest, and would continue for ever so unless disturbed by the action of some extrinsic force. Inertia itself is one of the inherent properties of matter, and is unceasingly recalled to our notice in every incident of life. (*See* GRAVITATION.)

INFECTION, *in-fek'-shun* (Lat.).—The propagation of disease by means of deleterious or offensive effluvia contained in the atmosphere.

INFINITE INFINITESIMAL. (*See* INTEGRAL CALCULUS.)

INFLAMMATION, *in-flam-mai'-shun* (Lat., *inflammatio*, from *inflammo*, I burn).—A preternaturally hot, red, swollen, and painful condition of any portion of the body. When the inflammation is general, it takes the form of fever. It is usually distinguished by a particular name according to the part which is attacked; as, *pleuritis*, inflammation of the pleura; *peritonitis*, of the peritoneum; *gastritis*, of the stomach; *hepatitis*, of the liver, &c. Inflammation may be produced by various causes,—by external injury, as a cut, bruise, or burn; by the action of some chemical or other agent, as poisons, alcoholic liquors; or from exposure to cold, wet &c. Inflammation may be acute or chronic; diffuse or circumscribed; healthy, with a disposition to heal and return to the natural state, or unhealthy, when, on the contrary, there is a disposition to ulceration, &c. It may teminate in one of three ways—in resolution, in suppuration, in mortification. The first of these is the most desirable mode of termination, being the gradual subsidence of the inflammatory action, and the return of the parts to their natural state, without any visible morbid change in their structure. In suppuration, the inflammation goes on to the formation of pus, when the swelling increases in size, becomes more red and shining, then grows soft in the centre, and at length the matter makes its escape either through a natural or an artifical opening. The most dangerous termination is in mortification, which is caused by the inflammatory action being too violent for the vital process of the part. The pain is at first very severe, then the bright-red colour of the part becomes livid, vesicles form on the surface, the pain abates, and the death of the part ensues. The immediate cause of inflammation is believed to be the exudation of the *liquor sanguinis* through the softened or ruptured walls of the capillary vessels of the part, in consequence of an increased flow of blood there. The mode of treatment in inflammation will of course vary according to the seat and character of the general symptoms. A low diet, purgative medicines, cooling drinks, diaphoretics, and the avoidance of all excitement, are also necessary. (*See* PLEURITIS, PERITONITIS, &c.)

INFLECTION, *in-flex-shun*, in Optics, is synonymous with the term diffraction, or that property of iight by reason of which, when it passes very near the borders of an opaque body, it is turned from its rectangular course. (*See* LIGHT.)

INFLEXION, POINT OF, in Geom., is that point of a curved line where the curvature in relation to the axis changes from concave to convex, or from convex to concave.

INFLORESCENCE, OR ANTHOTAXIS, *in-flor-es'-ens an-tho-tak'-sis* (Lat., *inflorescens*; Gr., *anthos*, flower; *taxis*, a placing).—A botanical term applied to the arrangement of the flowers on the axis, or to the ramification of the floral axis. The forms under which the flower-stalk is presented to our notice are described under PEDUNCLE; and many particulars relating to inflorescence are noted under BRACT. Flowers are variously arranged upon the floral axis, and to each arrangement a particular name is applied. These modifications are always the same for the same species of plant, and frequently throughout entire genera, and even natural orders; and hence their discrimination is of great practical importance. All the regular forms may be arranged in two great classes, the principles of which being understood, their subordinate modifications will be readily recognizable.

Class I.—*Indefinite, Indeterminate*, or *Axillary Inflorescence*.—The primary floral axis is terminated by a growing point analogous to the terminal leaf-bud of a stem or branch; it has consequently the power of growing or elongating in an upward direction, or of dilating more or less horizontally, there being no necessary limit to its growth. Such an axis, as it continues to grow upwards, develops on its sides other buds, from which flowers are produced. The general characters of the inflorescence in this class depend, therefore, upon the indefinite growth of the primary axis; while the secondary, tertiary, or other axes which are developed from it are terminated by flower-buds. The simplest kind of indefinite inflorescence is that presented by such plants as the pimpernel and moneywort, in which solitary flowers are developed in the axils of the ordinary leaves of the plant, the primary axis continuing to elongate in an upward direction, and bearing other leaves and flowers. The flowers are then said to be *solitary* and *axillary*. When such flowers are arranged in whorls round the stem, each flower being axillary to a leaf, as in the common mare's-tail, they are said to be whorled. When a number of flowers are developed, instead of a single one, upon an elongated or depressed axis, which is placed at the extremity of a branch or in the axil of a bract, a number of kinds of inflorescence arise, depending upon the extent to which the axis is divided, the mode in which the branching takes place, the comparative length of the flower-stalks, and other subordinate circumstances. These modifications are arranged under two heads :—1. Those with an elongated primary axis; and, 2, those with a shortened or dilated primary axis.

Class II.—*Definite, Determinate*, or *Terminal Inflorescence*.—In this class of inflorescence, the primary axis is arrested in its growth, at an early age, by the development of a terminal flower-bud ; and if the axis bears no other flowers, this is called a *solitary terminal* flower, and is the simplest form of definite inflorescence. It may be seen in the stemless gentian, the wood anemone, &c. When other flowers are produced on such an axis, they must necessarily arise from axillary buds placed below the terminal flower-bud, and if these form secondary axes, they will, in like manner, be arrested in their growth by a terminal flower-bud ; hence this mode of inflorescence is *definite*, in contra-distinction to the former, or indefinite inflorescence, where the primary axis elongates indefinitely, unless stopped by some extraneous cause. In definite inflorescences, the order of unfolding in the flower-buds is from the apex to the base, if the axis be elongated ; or from the centre to the circumference, if the axis be depressed or dilated. Such an order of expansion is termed *centrifugal*. The general name of *cyme* is applied to all inflorescences of this class.

Mixed Inflorescence.—Examples of this are by no means uncommon. Thus, in plants of the natural order *Compositæ*, the terminal capitulum is the first to expand, and the capitula, as a whole, are therefore developed in a centrifugal manner ; the individual capitula, however, open their small flowers or florets centripetally ; hence, here, the general inflorescence is definite, and the partial inflorescence indefinite.

INFLUENZA, *in-flu-en'-za* (Ital., influence ; so called because it was believed to be produced by the influence of the stars).—An epidemic febrile catarrh, differing from a common catarrh in the greater severity of its symptoms. It comes on suddenly, attacking many persons at once ; but though the symptoms are alarming, it is seldom fatal, except to the aged, or those of weakly constitution. The person is first seized with slight chills ; there is great heaviness and pain over the eyes, great prostration of strength, loss of appetite, quick, irregular pulse, cough and difficulty of breathing, with running at the nose and eyes. The duration of the disease varies from two or three days to as many weeks ; and frequently the debility continues much longer, occasioning, not uncommonly, relapses. Differences of opinion exist as to the immediate cause of this disease, some attributing it to a noxious principle existing in the atmosphere ; others to sudden changes of the weather, &c. ; but nothing is definitely known on the subject. In its treatment, little is required to be done beyond keeping the patient in bed, in a warm and agreeable temperature, and the administration of aperient and cooling medicines. When the difficulty of breathing is considerable, mustard poultices may be applied to the chest. When the fever has subsided, tonics and stimulants should be employed ; and should the cough remain obstinate, change of air will generally be found to be the most effectual means of removing it.

INFUSORIA, *in-fu-so'-re-a* (Lat., *infundo*, I pour in).—A class of very minute animalcules inhabiting stagnant water, fresh or salt, in which plants are growing, or in which an abundance of decayed animal or vegetable matter is contained. By means of the microscope we are able to perceive that a drop of water, though apparently perfectly clear to the naked eye, is really swarming with living beings. They are so extremely minute in size, that it is calculated that a moderate-sized drop of water may contain 500,000,000 of them. The infusoria are of very simple organization, as they have neither vessels nor nerves, are not symmetrical, have not distinct sexes, have no visible eggs, and are without determined or apparent digestive cavities. Their chief organs seem to be internal spherical cavities, frequently containing foreign particles derived from the surrounding water, and supposed to serve as food. Some of them have no apparent locomotive organs ; others have either cilia, or changeable processes, as they are called—expansions of the substance of the body. In most cases the substance of the bodies of infusoria consists of a glutinous, homogeneous, or slightly granular, transparent mass. Red specks resembling eyes have been observed in some varieties, and by many zoologists they are so considered ; while others deny it, on account of the absence of any nervous system and no appearance of any cornea or lens. The food of infusoria consists of decomposing vegetable and animal matter, and they frequently devour each other. They are the prey of other aquatic animals, and, as soon as they accumulate in large quantities, contribute largely to the nourishment of more highly organized beings which are useful to man. This has been particularly observed in cold climates, where vegetable life ceases to exist in the ocean. Infusoria are found to exist in these latitudes in inconceivable numbers, and form the principal nourishment of the fishes inhabiting those parts. Their mode of propagation is very remarkable : it consists in spontaneous division, which is either longitudinal or transverse ; in gemmation, the buds arising from the posterior part of the body ; in the incysted process, cysts forming, which, when they burst, liberate animalcules which do not resemble their parent in form ; and also in alternation of generations. (*See* GENERATIONS, ALTERNATION OF.) Infusoria frequently occur in such large numbers as to colour large tracts of water. Some of these impart a blood-red hue to the water, others a blue colour ; while others tinge the surface with green. They can resist a temperature of 24° below freezing-point, and a degree of heat equal to 260°.

INGUINAL. (*See* GROIN.)

INIA, *in'-e-a*.—A cetaceous animal (*Inia Boliviensis*), of the family *Delphinidæ*. It is one of the few cetacea which inhabit fresh water, and only one species is known. It resembles a dolphin in form, but has a long and slender snout. The length varies from seven to twelve feet. It is found in South America in the upper waters of the Amazon, and in lakes in the same region. A useful oil is yielded.

INJECTION, *in-jek'-shun* (Lat., *injicio*, I cast in), a medicated liquor thrown into some cavity of the body by means of a syringe or other apparatus. (*See* CLYSTER.) The injection of morphia into the veins to produce sleep is now resorted to in cases where objections exist to the use of the drug in other ways.

INNOMINATUM OS, *in-nom-in-ai'-tum* (Lat., *in*, without; *nomen*, a name; *os*, a bone).—The name given to the large irregular bone situated at the side of the pelvis. It is composed of three bones, which are distinct in the young subject, and are the *os ilium*, or haunch-bone; the *os ischium*, or hip-bone; and the *os pubis*, or sham-bone.

INOCARPUS. (*See* THYMELACEÆ.)

INOCULATION, *in-ok-u-lai'-shun* (Latin, *inoculatio*).—The insertion of a poison into the body of a person, more particularly applied to the practice of producing small-pox by taking a small quantity of the fluid from the eruption on the skin of one person, and inserting it under that of another. In this way a much milder form of the disease was produced than if it had been taken in the natural way. Hence the mortality of the disease was much lessened; but the practice was not without its evils, as it exposed the person to some risk, who might not have taken it naturally, and, by introducing the disease into a district previously free from it, might be the means of communicating it to others. Inoculation had been practised by the Indian Brahmas and by the Chinese from remote antiquity, and is generally said to have been introduced into this country about 1721, by Lady Mary Wortley Montague, who had seen it practised in Turkey. It appears, however, to have been known before this time in the south of Wales and the Highlands of Scotland. Since the introduction of vaccination, inoculation has fallen into disuse. (*See* VACCINATION.)

INSANITY, *in-san'-e-te* (Lat., *in*, not; *sanus*, sane, sound), is one of the most terrible disorders to which the human race is subject. The causes which may lead to insanity, particularly in those whose mental constitution is weak, are very numerous. In many cases, the tendency to insanity is hereditary, and transmitted from parents to children. Drunkenness, excessive study, strong mental excitement, grief, jealousy, disappointment, frequently lead to it. Religious excitement is also not an unfrequent cause. Sometimes insanity comes on quite suddenly, without any warning whatever; at other times there is a previous derangement of the animal functions, loss of appetite, restlessness, and want of sleep. It is usual to distinguish insanity into different kinds; as—1. Moral insanity; 2. Intellectual insanity; 3. Mania, or raving madness; 4. Dementia, imbecility, fatuity. Usually, however, two or more of these kinds occur together. Moral insanity frequently manifests itself in a desire to steal, or appropriate the property of others. In monomania, the patient reasons correctly upon all matters except one, which forms the subject of his insanity. Imbecility usually commences with loss of memory and the power of concentrating the attention, for any time, upon one subject; then all control is lost over the thoughts, and the mind wanders meaninglessly from one subject to another; at length there is a carelessness to all that is going on around, and life may become a mere existence, the mental faculties being entirely lost. Idiocy differs from imbecility, in being congenital, while the latter is acquired or produced by disease. (*See* IDIOCY.) The chance of recovery from insanity depends greatly on its complication, or otherwise, with other diseases, particularly epilepsy or paralysis, with either of which it is nearly hopeless. It is also influenced by the form of the disease, the period of its duration, the age, sex, and constitution of the patient. The mean duration of cases terminating favourably is from five to ten months; after the latter period, recovery is very doubtful. In advanced life, insanity is generally permanent, and imbecility is very rarely curable. While insanity may arise from some affection of the brain which speedily terminates in death, yet, in general, it is not necessarily a fatal disorder, for lunatics have been known to live thirty, forty, or fifty years after being seized with their disease. It is one of the signs of the advance of the present age, that the treatment of the insane is no longer what it was; they are no longer loaded with chains and confined to some dungeon, but are treated with kindness and consideration, and allowed all the liberty that the nature of their malady admits of. In the cure of insanity, in which great progress has recently been made, the means adopted naturally resolve themselves into medical and moral. When the malady proceeds from, or is accompanied by, physical derangement, as it usually is, it is necessary to ascertain the nature of this, and to take means for its removal. If there be excitement and inflammatory action, mild antiphlogistic measures will be necessary, together with aperients and a low diet. If, on the contrary, there is debility and prostration of strength, a nourishing diet will be required. When, as is often the case, want of sleep is an attendant sympton, opiates are to be given. In all cases, exercise, fresh air, and cleanliness are required. The moral treatment of the insane conists in diverting their thoughts by occupations and amusements, and in gaining their confidence by kind and conciliatory measures. To M. Pinel, of France, is the world indebted for having been the first to introduce conciliatory measures in the treatment of the insane.

INSECTA, *in-sek'-ta* (Lat., *insectus*, divided into segments), a class of invertebrate animals, belonging to the sub-kingdom *Annulosa*. The following may be taken as a definition of a true insect:—An articulated animal having six legs, two antennæ, two compound eyes; a small brain at the anterior extremity of a double medullary chord; circulation effected by a pulsating dorsal vessel provided with numerous valves; respiration by tracheæ, which form two lateral trunks, and ramify through the body; generation oviparous; two distinct sexes; adult state attained through a series of metamorphoses. (*See* INSECT-TRANSFORMATIONS.) In general, every insect possesses two pairs of wings; the trunk in the adult animal is usually composed of three chief parts—the head, thorax, and abdomen. The trunk of an insect may also be described as consisting of thirteen segments; of which one constitutes the head, three the thorax, and nine the abdomen. The eyes are almost always two in number, placed on either side of the head, and composed of hexagonal lenses. The stemmata are minute simple eyes, and may be seen in the orders Hymenoptera, Orthoptera, and Hemiptera. They are also possessed by the larvæ of coleopterous insects. (*See* EYE.) The antennæ are two-jointed organs, usually springing from the upper surface or side of the head, near the eye. These organs vary greatly, not only in different species, but often in the sexes of the same species. Much difference of opinion exists as to the use of these antennæ. By some they are considered organs of hearing, while others aver that they are organs of touch or smell. It is probable that they are used for different purposes by different varieties of insects. The term thorax is applied to all that portion of an insect which lies between the head and the abdomen, and to which the legs and wings are attached. The three segments of the thorax mentioned before are called the protothorax, the mesothorax, and the metathorax respectively, passing from the head to the abdomen. The protothorax bears the anterior pair of legs, and is largely developed in the Coleoptera, Orthoptera, and Hemiptera; but in the Lepidoptera it merely forms a narrow ring, and in the Hymenoptera, frequently a distinct neck. (*See* various headings.) The mesothorax is more complicated than the first section, since it bears a pair of legs and the anterior pair of wings. It is well developed in all insects. The metathorax bears the posterior wings, and is well developed in those animals which have them; but in those insects which want them, as the Diptera, the metathorax is small. In the abdomen of insects, although nine segments are always visible in the larvæ, there are seldom more than seven or eight visible joints in the perfect insect. The substance of which the abdominal segments are composed is always softer and more flexible than that of the head and thorax. To the abdomen, which never possesses organs of locomotion, are attached various appendages, which differ very much in different families. The digestive system is well developed, and consists of an intestinal canal, in which a crop, gizzard, stomach, and small intestine, are generally distinct; but these parts vary according to the nature of the food, similarly to those of the higher order of animals. The circulation of the blood in insects is carried on by distinct vessels, and also by a channel in the intestines. Its central organ is the dorsal vessel. The muscular system of insects is highly developed, and their locomotive powers far surpass those of any animal whatever. Insects possess great powers of multiplication. Their eggs are very variable in shape, but their general form is oval; they are, however, often round, and sometimes cylindrical. In the ordinary language of entomology, the term "larva" is applied to the insect from the date of its escape from the egg to the time when its wings begin to appear. About 200,000 distinct species of insects are known. Exhibitions of insects illustrating their structure, food, and habits have been held, at the Tuileries, Paris, in 1874; at the Westminster Aquarium, 1878; and at the Zoological Gardens, Regent's Park, in 1881. (*See* ENTOMOLOGY.)

Insect-Transformations, *trans-for-mai'-shuns* (Lat., *trans*, beyond; *formo*, I make).—When the larvæ of an insect leave the egg, they are often very unlike the parent, and require several changes of form before they assume the perfect shape. As the young animal increases in size, its integument becomes too small, and is thrown off, while a new one forms in its place. This moulting or change of skin takes place several times, generally as many as five, before the larvæ attain their full growth. At the period of the last change, many insects spin a cocoon of silky fibres, others dig a hole in the ground, and in these retreats await their second transformation, changing into the state of nympha or pupa while there. They continue immovable, and in a state of repose, for a certain time varying from a few days to some weeks, months, or even, in a few, to a couple of years. Great changes take place in the organs of insects during this period. They gradually become developed, till, at the proper time for becoming mature, the perfect insects burst forth from their pupa-cases. In the course of insect-transformation, the grade of development at which the insect primarily leaves the egg is very different in the several orders and families. In all cases, the embryonic mass within the egg is first converted into a footless worm, resembling the higher Entozoa, or the inferior Annelida, in its general organization, but possessing thirteen segments, the typical number of the class of insects. In the Diptera, Hymenoptera, and in some of the Coleoptera, the head of the larvæ, which are known as "maggots," differs little from the segments of the body, the eyes in many cases not being developed, and the mouth being furnished with a mere suctorial disc. In the Lepidoptera, and most of the Coleoptera, at the time of escape, the larva possesses the rudiments of three pairs of thoracic legs, although they are little else than simple claws, except in the carnivorous beetles. These larvæ are usually designated "caterpillars." The transformation of insects was observed by the ancient Greeks and Romans, and amongst them a butterfly, or perfect insect, was used as a symbol to represent the soul.

Fossil Insects.—The oldest fossils belong to the carboniferous period, and mostly consist of fragments of Neuroptera, Orthoptera, and Coleoptera. Fossils of a small size are found in the Lower Lias, but the fragile bodies of insects soon decompose, and compared with animals of bony structure, the fossils are few.

INSECTIVORA, *in-sek-tiv'-o-ra* (Lat., insect-eaters), an order of carnivorous quadrupeds synonymous with Glires, and deriving its name from the habits of the species belonging to it. Their distinguishing characteristics are the conical points on their teeth, for the purpose of crushing the hard outer coverings of the insects on which they feed. They are divided into four different families;—the Talpidæ, or moles; the Soricidæ, or shrews; the Erinaceadæ, or hedgehogs; and the Tupaidæ, or banxrings, a group of animals inhabiting the East Indies, and bearing a close resemblance to squirrels in their appearance and habits. The term Insectivora is also applied to an order of birds and to many plants, more correctly described, however, as carnivorous plants, especially the *Droseraceæ*.

INSESSORES, *in-ses-so'-res* (Lat., perchers).—An order of birds, *Passerine* (sparrow-like), containing by far the larger number of existing birds. The feet are peculiarly adapted, by the three toes before and one behind, for perching on branches of trees. Singing-birds belong to this order, of which there are four leading divisions—Dentirostres, Conirostres, Tenuirostres, and Fissirostres. (*See* various headings.)

INTEGER, *in'-te-ger* (Lat., entire).—The name of a whole number, in contradistinction to a fractional number. Thus, in the number 94·7, 94 is an integer, and 7 a fraction, or seven-tenths of a unit.

INTEGRAL CALCULUS, *in'-te-gral kal'-ku-lus* (from Lat., *integer*, entire).—As the integral calculus forms one of the most important branches of modern mathematics, and as it is so intimately connected with differentials, it has been deemed best to combine the two in their approximate relationship, rather than to enter upon each separately. A definition of the words, therefore, has been merely given under the headings CALCULUS and DIFFERENTIAL CALCULUS, further explanations being given in the present article. (1) The object of the differential calculus may be stated briefly to be to find the ratios of the differences of certain variable magnitudes, on the supposition that these differences become *infinitely small*; and this hypothesis gives rise to considerable abbreviations in the general calculation of differences. It must be first born in mind that every magnitude which serves the purpose of mathematical investigation can be augmented or diminished, without any limit as to extent. We may, consequently, imagine a quantity to become so great as to exceed any finite assignable quantity of the same nature as itself, or so small as to be less than any finite assignable quantity as itself: in the former case, the quantity is said to be infinite, and in the latter infinitely small. From these data it may be said that a finite magnitude may be regarded as nothing, or zero, in comparison with one infinitely great, and an infinitely small magnitude as nothing, or zero, in comparison with a finite magnitude. The infinitely small quantities which come under consideration in the different calculus are called *differentials*; and hence the connection between the terms infinite and infinitely small with the present subject. The following are the principles of the differential calculus. One quantity, u, is said to be a *function* of another, x, when the value of the magnitude of u depends upon the variation of x. Thus, the area of a triangle is the function of the base when the altitude remains unaltered; since the area will increase or decrease with the increase or decrease of the base. If $u=ax^2\ bx$, where a and b are constant quantities, and x a variable one, u is said to be a function of x, since if x changes, the value of u will be altered: this relation between u and x is usually expressed by writing $u=f(x)$, or $\phi(x)$, the symbols f and ϕ expressing the word function. The quantity x is called the independent variable, and u the dependent variable. The differential of a variable may be truly defined to be the infinitely small difference between two successive states of the same variable, and the object of the calculus is to find this differential for all possible cases; that is to say, for all the possible functions of the proposed variables, such as x, y, z, &c., of which the particular differentials are expressed by dx, dy, dz, &c. It will be necessary to examine into the distinctions that must be made between the process by which an ordinary, or finite difference, is obtained, and that to which we must have recourse when the difference is infinitely small, or, in other words, is a differential. If we consider the proposed system or function in any two determinate states different from each other, the difference of the two values of the same quantity taken in the two states will be determinate, and consequently cannot be considered as minute as we please, so that no part of its expression can be omitted; but if the two states of the function approach indefinitely near each other the difference of the two values of the same variable may be rendered as small as we please. It then becomes a differential, and is in fact nothing more than the ordinary difference simplified by the suppression of the quantities which in its expression may be regarded as infinitely small in comparison with the other quantities of which it is composed. Such may be said to be the general principle of differentiation. The differential co-efficient of the term of any functions equals the sum of the differential co-efficients of each function. The primal principle of the differential calculus may be defined to be its application to the equations of curves, by which means the radii of curvation are able to be discovered by a few simple formulas. It also applies to the finding of the maxima and the minima, investigations with regard to sines, and numerous other mathematical inquiries, which, without its aid, could only be solved by the most laborious and difficult methods. It was invented by Leibnitz. A dispute arose between him and Newton on the subject of the discovery. (*See* FLUXIONS.) The Integral Calculus is the direct reverse of the differential, its object being to discover the original function from a given relation between the differential co-efficients and functions of two quantities. Lagrange has worked out three different classes of differential equations. The *Calculus of Variations* is that which treats on the finding of the maximum and maximum, and also on the nature of the functions which possess that property. This variety of Fluents is merely another form of differentiation under a new symbol. The *Infinitesimal Calculus* is the art of employing infinitesimal quantities as auxiliaries, in order to discover the relations which exist among the proposed quantities. (*See* FLUXIONS.)

INTERCOSTAL, *in-ter-kos'-tal* (Lat., *inter*, between, and *costa*, a rib).—A term applied to certain muscles, vessels, &c., situated between the ribs. There are two sets of intercostal muscles—the external and internal, which decussate each other like the strokes of the letter X.

INTERMITTENT, *in-ter-mit'-tent* (Lat., *inter*, between; and *mitto*, I send).—Diseases which are not continuous, but intermit for a time, and then return again, as in intermittent fevers. (*See* FEVER and AGUE.)

INTERPOLATION, *in-ter-pol-ai'-shun* (from Latin, *interpolo*, I place between).—A term applied in Algebra and Astronomy to a method employed for filling up the intermediate terms of a series of numbers or observations, by numbers which follow the same law. The method itself is dependent upon the following problem:—Let there be given two series of numbers, the corresponding terms of which have some determinate relation to each other, and of which the first is called the series of roots, and the second the series of functions (*see* INTEGRAL CALCULUS); to find the function corresponding to any term in the series of roots, from the numbers in the series of functions which precede or follow that which is required, this is a question of *interpolation*.

INTERSECTION, *in-ter-sek'-shun* (from Lat., *inter*; and *seco*, I cut).—A term applied in Geometry to the point of meeting, or function of lines or surfaces.

INTESTINAL WORMS, *in-tes'-ti-nal* (Lat., *intestina*, an intestine).—A class of animals which infest the interior of other animal bodies and, as its name implies, especially the intestinal tube. The entozoa, or intestinal worms, form a family, or class, of the sub-kingdom of Zoophytes. Rudolphi introduced the term entozoa into the language of natural history; and the word has been adopted, not only in this country, but also in France and Germany. (*See* ENTOZOA.) It includes all those animals which naturally and permanently inhabit the intestines, or any other internal part of animal bodies. These creatures do not, however, infest every animal indiscriminately; on the contrary, the parasites of nearly every species are peculiar to itself, or they are confined to a few, the habits and structure of which are analogous. The reasons which determine these parasites to select individual animals are unknown; but it would appear that worms generally infest the delicate and sickly; that in some cases youth seems to favour their production, and in others maturity. The generation of an intestinal worm, called the *fluke*, in sheep and cattle, is said to be favoured by rich moist pastures. Salt pastures, on the contrary, are said to be destructive to the fluke and worm. According to Dr. Paris, "salt, when taken in modern quantities, promotes, while in excessive ones, it prevents digestion: it is therefore tonic and anthelmintic, correcting that disordered state of the bowels which favours the propagation of worms." Although intestinal worms are found principally in the alimentary canal and the viscera subservient to its functions, they are, however, not confined to this portion of the body. Some species have their appropriated seats in the cellular, adipose, and serious tissues, and in the parenchyma of the most secret organs. One species is found in vast numbers in the voluntary muscles, and more than one has penetrated the heart. Several are developed in the brain, the lungs, and air-passages, the liver, and the kidneys; one or more have entered the blood-vessels, or tumours connected with them; others are to be found in the humours of the eye, and several specimens in the urinary secretions.

Classification.—The variety of external form in all intestinal worms is sufficiently great to form the basis of their classification into five subordinate divisions. 1. Nematoidea (Gr., *nema*, a filament; *eidos*, a form) round worms. The body of these worms is cylindrical and elastic, with the intestinal tube terminated at one end by the mouth, at the other by an anus; the sexes are separate. 2. Acanthocephala (Gr., *acanthos*, a thorn; *cephale*, a head): hooked worms. Their characteristics are—a roundish body, utricular and elastic; proboscis retractile, armed with spinules arranged in rows; sexes distinct. 3. Trematoda (Gr., *trema*, a hole): fluke-worms. Their characteristics are—a flattish, soft body, of various forms, often tending to oval; one or more pores on its under surface. They have no intestinal canal, and the organs of generation of the two sexes co-exist in the same individual. 4. Cystoidea (Gr., *kestos*, a band; *eidos*, a form): tape-worms. These parasites have a soft, elongated body, flat like a riband, in some continuous, in others articulated; the head is either only simply labiated, or provided with pits, or with two or four suctorious orifices. There is no trace of an intestinal canal, and the male and female organs are present in each individual. 5. Cystica (*kustis*, a bladder): hydatids (which *see*). The characteristics of these worms are—a flattish, or rounded body, terminating posteriorly in a transparent bladder-like cyst, filled with a pellucid fluid, which is sometimes common to many individuals; head provided with two or four pits, or with four suckers, and with a circle of hooklets, or with four unarmed or uncinated tentacles. The sexual organs have been hitherto indiscernible.

INTESTINES, *in-tes'-tins* (from Lat., *intus*, within).—That part of the alimentary canal which extends from the stomach to the anus, and is situated in the cavity of the abdomen: the entire length of the intestinal canal is about six times that of the body. It is composed of three coats, or membranes—the peritoneal, the muscular, and the villous. It is divided into the small and large intestines. The small intestines have three divisions—the duodenum, so called from its length being about twelve finger-breadths, and which commences at the pyloric end of the stomach; the jejunum, so named from being generally found empty; and the ileum. The large intestines have likewise three divisions—the cæcum, colon, and rectum. Each of the parts will be found described separately under their own names. The small intestines have internal membranous folds called *valvulæ conniventes;* while the large intestines have three strong muscular bands, which run parallel upon this surface.

INTOXICATION, *in-toks-e-kai'-shun* (Lat., *in;* and *toxicum*, a poison).—The state produced by the excessive use of alcoholic liquids or inebriating substances. In general, intoxication comes on gradually, and several stages may be noted in it progress. Thus, it shows itself at first by a general liveliness and excitability; during this stage, the circulation of the blood becomes more rapid, and all the functions of the body are performed with more freedom. No surcharge of blood, however, is produced, either in the head or lungs, by the excitement. While in this condition, indeed, the mental powers seem to act more freely; the imagination is stimulated, the fancy is more lively, and the feeling of strength and courage is increased. The effect on the brain is much more decided in the second stage of intoxication. Then all the peculiarities of character, the weaknesses and failings of temperament which the individual can keep under and conceal in his sober moments, manifest themselves. Consciousness begins to be attacked, secret thoughts and the sense of propriety are lost. The peculiarities of this stage are summed up in the old proverb, *in vino veritas*, "in wine there is truth." In the next stage, consciousness is still more weakened, the balance of the body cannot be kept, the sight becomes confused, and the brain dizzy. After this point, the mind seems to be entirely overwhelmed by the tumult of animal excitement, consciousness is utterly extinguished, the tongue can only mutter incoherent gibberish, the face becomes suffused with blood, the eyes protrude, and perspiration streams from the pores of the skin. Lastly, when completely prostrated, the victim of intoxication sinks into a heavy slumber, closely resembling the stupor of an apoplectic fit. The habitual drunkard pays a terrible price for his temporary enjoyment. He is liable to disease of the heart and the liver, to dropsy, intestinal affections, apoplexy, and palsy. The last scene of all is generally imbecility of mind and body. The expectation of life for a temperate man 50 years old, is estimated at 20 years; of an habitually intemperate man only four years. At earlier ages the deaths of drunkards are four or five times as many as the deaths of the temperate members of the community. (*See* TEMPERANCE.)

INULA, *in'-u-la* (its Latin name).—A genus of the natural order *Compositæ*, consisting of numerous species, found in every part of the world. The root of *I. Helenium*, or elecampane, one of the largest of British herbaceous plants, yields a starch called *inulin*, which has been used medicinally from the time of Hippocrates. It is an aromatic, tonic, expectorant, and diaphoretic, and has been prescribed in chronic catarrh and in dyspepsia.

INULIN. (*See* INULA.)

INVARIABLE. (*See* VARIATION.)

INVERSE PROPORTION. (*See* PROPORTION.)

INVERSION, *in-ver'-shun*, in Mathematics. (*See* INTEGRAL CALCULUS.)

INVERTEBRATA, *in-ver-te-brai'-ta* (Lat., *in*, not; *vertebra*, a joint of the back-bone).—In Zoology, is a negative term, first employed by Lamarck to designate animals destitute of a vertebral column or back-bone. The Invertebrata constitute three out of the four great divisions of the animal kingdom; viz., Articulata, Radiata, and Mollusca. (*See* VERTEBRATA, or ANIMAL KINGDOM.)

INVOLUCRE, *in-vo-lu'-kr* (Lat., *involucrum*).—A whorl of bracts placed round the base of an umbel, a capitulum, or sometimes a single flower. In some umbelliferous plants—as, for instance, the carrot—there are two kinds of involucre, one at the base of the primary divisions of the floral axis or general umbel, and another at the base of each of the partial umbels or umbellules: the former is then called the *general involucre*, and the latter an *involucel*, or *partial involucre*. In the involucres of the heads of flowers in the natural order *Compositæ*, such as the marigold, daisy, &c., there are frequently two or three rows of bracts overlapping each other. To these overlapping bracts the term *phyllaries* has been applied. (*See* BRACT.)

INVOLUTE CURVE, *in'-vo-lute* (Lat., *involutio*, unfolding). (*See* EVOLUTE.)

INVOLUTION AND EVOLUTION, *in-vo-lu'-shun*, *ev-o-lu'-shun* (Lat., *involuto*, I enwrap, enfold).—In Mathematics, two distinct operations, one of which is the reverse of the other. *Involution* consists in raising the power or index of a number by multiplying it successively into itself. Thus, to raise 4 to 4^3, or 64, is a process of involution, and is performed by multiplying 4 by 4, and again by 4. Involution in algebra is exactly the same as in arithmethic, symbols only being used instead of figures. *Evolution* is the reverse of involution, and consists in finding the original power of the number from the index to which it has been raised.

IODIC ACID, *i-od'-ik* (from iodine).—An acid corresponding in composition to chloric and bromic acids. Equal parts of iodine and chlorate of potash are mixed in five parts of water. Chlorine is evolved, and iodate of potash remains dissolved in the water. Chloride of barium is next added, which yields an abundant precipitate of iodate of baryta, which is sparingly soluble in water. It is washed and just enough sulphuric acid is added to it to combine with the baryta. The iodic acid dissolves in the water, and sulphate of baryta is precipated. The iodic acid may be obtained in crystals of the formula IO_5 HO, by careful evaporation. Organic bodies decompose it; owing to which circumstance litmus-paper is first bleached, and then reddened by it.

IODINE, *i'-o-dine* (Gr., *iodes*, violet-coloured), one of a group of four non-metallic elements known as Halogens. Iodine was discovered by Courtois, in 1811, in the waste liquors produced in the manufacture of soda from sea-weed. It is contained in nature, principally in sea-plants and sea-water, in the forms of iodide of sodium, potassium, and magnesium. It also occurs combined with silver in *iodite*, a mineral found sparingly in Peru. The great source of iodine is burnt sea-weed, commonly known as kelp. It is largely manufactured at Glasgow from kelp made on the Scotch and Irish coasts. Iodine generally occurs in commerce in the form of bluish-black scales having a metallic lustre somewhat resembling plumbago. At ordinary temperatures, it is volatile, emitting an odour closely resembling chlorine, but somewhat weaker. Its specific gravity is 4·947. It fuses at 250°, and boils at 347°, giving forth a magnificent violet vapour, from which it derives its name. Taken internally, in large doses, it is a violent poison, but in small quantities, it is much employed in medicine to remove glandular swellings and goitres. It turns the skin, and most organized bodies, a deep brown, corroding them, if present in large quantities. Water dissolves only a small quantity, which gives the solution a yellow colour. Its bleaching properties are feeble. Alcohol, ether, and solutions of the iodines, dissolve it freely. Iodine attacks the metals freely, iron or zinc being dissolved, if placed with it in water. The compounds of iodine with the metals are decomposed by chlorine. Iodine forms a blue compound with starch, a property used as a test to determine the presence of either body. The principal compounds of iodine are iodic acid, hydriodic acid (which will be found described under their respective headings), and the chloride and bromide of iodine. With chlorine, iodine forms two compounds—the protochloride, a deep brown, deliquescent liquid, obtained by distilling iodine with chlorate of potash; and terchloride of iodine, a compound formed by the prolonged action of chlorine upon iodine. It occurs in crystalline orange needles, soluble, with partial decomposition, in water. With bromine it forms two unimportant compounds—the protobromide and pentabromide. The compounds in which iodine is united to a base will be found described under the heads of the bases. In examining the properties of iodine, bromine, and chlorine, it is impossible not to be struck with the close analogy between these bodies. They form one of those remarkable triads which we find existing amongst the elements, of which sulphur, selenium, and tellurium, lithium, sodium, and potassium, are examples.

IODITE, *i'-o-dite*.—An exceedingly rare mineral, containing iodide and bromide of silver, found in Mexico and Chili. It occurs in flexible plates of a pearl-grey or yellowish-grey colour. It has also been found in small quantities at Guadalaraga, in Spain.

IOLITE, *i'-o-lite* (Gr., *ion*, a violet; *lithos*, stone).—A genus, known also as dichroite, cordierite, and prismatic quartz. It occurs in granitic and primitive rocks, associated with garnet, quartz, and iron and copper pyrites. Its colour varies from violet to dark blue.

IONIDIUM, *i-o-nid'-e-um*.—A genus of the natural order *Violaceæ*. The root of the species *I. Ipecacuanha* is the *woody* or *false ipecacuanha* of Brazil, and is employed as an emetic in that region. It contains the principle *emetina*. Other species, as *I. parviflorum*, *I. itubu*, &c., have similar properties; the roots of the former constitute the *Cuchunchully de Cuença*, which is much used in Venezuela as a remedy for elephantiasis.

IPECACUANHA, *ip'-e-kak-u-an'-na*.—A name adopted from the language of the South Americans, and applied to a variety of emetic roots, but restricted in the Pharmacopœias to the roots of a species of *Cephaëlis* (which *see*). The officinal root is sometimes called annulated ipecacuanha. The root known as undulated, white, or amylaceous ipecacuanha, is the produce of a species of *Richardsonia*; that known as black, or striated, is obtained from a species of *Psychotria*; and that called woody or false ipecacuanha, from a species of *Ionidum*. Ipecacuanha is valuable in medicine as an emetic. It is administered as a powder or in a liquid form known as Ipecacuanha wine. (*See* DOVER'S POWDER.)

IPOMŒA, *ip-o-me'-a* (Gr., *ips*, a worm which infests the vine; *omoios*, like, from its habit of twining round other plants, like the creeping of a worm).—A genus of the natural order *Convolvulaceæ*. There are many species, mostly natives of warm countries. Some of them are, from their large and beautiful flowers and large leaves, very ornamental. The roots of the species *I. orizabensis* are sometimes found intermixed with those of *Exogonium purga*, the true jalap of the Pharmacopœias. This spurious jalap is known in Mexico as *male jalap*, and in English commerce as *woody jalap*. It has similar properties to those of the well-known drug, but is less powerful. The roots of *I. Turpethium*, or the Turpeth, were formerly much used as a purgative. The large roots of *I. macrorrhiza* contain much farinaceous matter, and are used as food by the inhabitants of Georgia and Carolina.

IRIARTEA, *i-ri-ar'-te-a*.—A genus of South American palms. The stems are tall and smooth, and the leaf-stalks rise from a sheathing column. One species, the Piziura Palm (*I. exorhiza*), sends out roots above ground which extend downwards, and frequently branch out before reaching the ground. As the tree grows, new roots are thrown out, and the old ones die, leaving large cavities high enough for a man to walk through. The wood is very hard.

IRIDACEÆ, *i-rid-ai'-se-e*.—The Iris or Cornflag family, a natural order of *Monocotyledones*, sub-class *Petaloideæ*, consisting of herbaceous plants. The plants of this order are chiefly natives of temperate and warm climates; they are particularly abundant at the Cape of Good Hope. A few species are British. There are 57 genera and about 600 species. The rhizomes of several species have acrid properties, which render them purgative or emetic; those of others are fragrant. Colouring matter is obtained from some species. Some of the genera furnish the horticulturist with showy border flowers. Some species have a medicinal value, and the root stocks of some are edible. (*See* IRIS, CROCUS, GLADIOLUS.)

IRIDIUM, *i-rid'-e-um* (Lat., *iris*, the rainbow, from the variety of colours exhibited by its salts).—A somewhat rare metal, found native, and nearly pure, amongst the Uralian platinum ores. It also occurs combined with osmium. Iridium is obtained from either of these sources —by fusing the chloride of potassium and iridium, and reducing the iridium by means of a current of hydrogen. Iridium is a very hard, white, brittle metal, only fusible by the most intense heat. In its pure state it is unacted on by any of the acids or aquaregia. It forms three compounds with oxygen, which readily pass one into the other, causing the solutions of their salts to assume a variety of colours. From these changes of colour the name has been conferred on the metal. It also forms sulphides and chlorides, but its salts have been very imperfectly examined.

IRIS, *i'-ris*.—The Flower-de-Luce, the typical genus of the natural order *Iridaceæ*. The species are very numerous, and are generally remarkable for their large yellow, white, or blue flowers, and sword-like leaves. They abound in Europe, but are numerous in North America. The rhizomes of several species are more or less purgative and emetic. Those of *Florentina*, *pallida*, and *Germanica* possess a violet odour, and are used in perfumery for imparting an agreeable odour to the breath, and by the French especially for making issue-peas. The rhizomes, dried and scraped, constitute the *orris-root* of the shops. In the southern parts of England, *I. fœtidissima*, or stinking iris, so named from the unpleasant odour of its leaves, is very common. The roasted seeds of *I. pseudoacorus*, the yellow flag of this country, have been recommended as a substitute for coffee, but they do not appear to have any of the valuable properties of that beverage; the genus is named from Latin *iris*, the rainbow, on account of the variety of colours exhibited by it.

IRIS. (*See* EYE.)

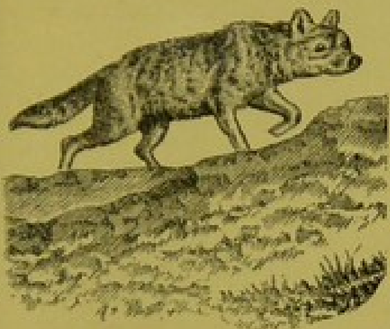
IRISH MOSS. (*See* CARRAGEEN.)

IRITIS, *i-ri'-tis*.—An inflammation of the membrane of the eye. It usually commences with pain in the eye and intolerance of light; afterwards the colour of the iris changes, owing to the secretion of coagulable lymph, which spreads over it in a fine flake. Iritis, if it go on, is likely to end in adhesion in the iris to the neighbouring parts, in which case there is a loss of the power of contracting and dilating, or it may even be completely closed. Sometimes an abscess forms and bursts, discharging its contents into the anterior chamber of the eye, and causing an entire loss of vision. In the treatment of this disease, leeches and cupping, and cold applications to the eye, are to be employed; mercury and extract of belladonna are employed as a lotion.

IRON, *i'-urn* (Sax., *iren*).—This important metal is most extensively diffused over nature, occurring not only in the inorganic kingdom, but entering into the composition of vegetable and animal structures. It occurs in nearly every part of the earth, in the form of ores. In the perfectly pure state it is almost unknown. It has also been occasionally found native amongst the ores of platinum. It occurs in the metallic state with nickle, cobalt, and other metals, in meteoric stones, some of which weigh as much as fourteen or fifteen tons. (*See* AEROLITES). The chemical symbol of iron is Fe, from the Latin word *ferrum*; the atomic weight is 56 and the specific gravity ·8439. In its pure state, iron presents a dusky-grey colour and a rather feeble lustre, which is greatly improved by polishing. It is not affected by dry air or oxygen; but if moisture be present, it gradually passes into the state of hydrated sesquioxide, or rust, as it is termed in common parlance. At first, the process is slow, but after a time the spot of oxide forms the negative pole of a voltaic combination, and the oxidation proceeds rapidly. The same thing occurs if any other metal be present; thus, the parts of iron railings which are in contact with the soldar used in joining them together, are rapidly eaten away when exposed to the weather. Iron combines with most of the metals to form alloys, and directly with the iron metallic elements. It decomposes the diluted hydrogen acids with great facility, eliminating hydrogen. Nitric acid attacks it with evolution of binoxide of nitrogen. Under certain circumstances, iron is capable of assuming what is termed the *passive condition*. If a piece of clean iron wire be introduced into nitric acid of about 1·35 specific gravity, it is acted upon with great rapidity; but if the metal be touched beneath the surfaces of the acid with a piece of gold, platinium, or plumbago, the action ceases. If a second wire be made to touch the first, and then dipped into the acid, it is also rendered passive. The second wire may also be used to render a third wire inactive. If, however, any of these wires be exposed to the air for a few seconds, they return to their original condition. The same occurs when iron is plunged into nitric acid of specific gravity 1·45, in which it may be kept for years without losing its brilliancy, and if withdrawn and plunged into acid of 1·35, it has no action on it. If it be wiped, however, before doing so, it is dissolved by the weaker acid. The passive condition of iron is supposed to be due to a change in its metallic condition. Dilute sulphuric acid also dissolves iron with evolution of hydrogen. Iron in the metallic state is of great use to the chemist for precipitating certain metals, such as copper, from their solutions in the metallic form. By careful fusion and gradual cooling, iron may be obtained in cubical and octahedral crystals. In ductility and tenacity, iron exceeds all other metals, a piece of iron 1½ inch square having been known to bear a strain of 64 tons. It is inferior to many metals as a conductor of heat and electricity. One of its peculiarities is its capability of being attracted by the loadstone or electro-magnet, and of being converted by them into a permanent magnet. Heated to redness, iron loses its magnetic property, but regains it on cooling. Its uses are too well known to need description. Iron is converted into steel by being combined with a certain amount of carbon. (*See* BESSEMER'S PROCESS, AND STEEL.

Metallurgy, Iron of.—The principal ores of iron may, for convenience, be divided into two great classes:—1, the OXIDES; and 2, the CARBONATES. The oxides used as ores are somewhat numerous; but may be divided into four distinct classes:—1. *Magnetic iron ore.* This ore consists of the protoxide and sesquioxide of iron, mixed with small quantities of silica. It generally contains 69 per cent. of peroxide and 31 of protoxide—the impurities being so small as not to be counted. It occurs in massive beds in different parts of the earth, more especially at Arendahl and Dannemora, in Sweden. It is also found abundantly in different parts of America. The iron made from it is of great purity, being perfectly free from sulphur or phosphorus; hence the Swedish and Yorkshire iron, which is made from it almost entirely, is more valuable than any other. The titaniferous iron sand found at Taranaki, in New Zealand, consists almost entirely of magnetic iron ore and titanium. Titanium appears to exercise a most beneficial influence on steel containing small portions of it; the Taranaki sand is therefore much valued on this account. 2. *Specular iron, oligist*, or *iron glance*. This ore, which is found principally in the island of Elba, occurs in rhombohedral crystals, which possess great lustre. It is composed of sesquioxide of iron, with a small admixture of magnetic oxide. *Micaceous iron ore* has nearly the same composition, the crystals being in brilliant plates instead of in rhombohedral masses. It is found in small quantities amongst the hæmatites of Wales and Lancashire.—3. *Red hæmatite.* This important ore is found in uniform, radiated, fibrous masses, in different parts of the world, and consists of the sesquioxide of iron nearly in a state of purity. It is found in large quantities in Wales and Lancashire, some of the specimens from the latter locality containing nearly 99 per cent. of sesquioxide, the remainder being silica. It makes excellent iron. 4. *Brown hæmatite.* This ore consists of sesquioxide of iron in a state of hydration, and occurs in reddish-brown masses of a botryoidal, stalactitic, or reniform shape. Hydrated sesquioxide of iron is also found in amorphous masses mixed with clay. Bog-iron ore belongs to this class. It is a valuable ore, and is found in England, Wales, and Scotland. The CARBONATES are principally two:—1. The *spathose ore*, or sparry protocarbonate, which is found principally in crystalline masses in and about Siegen, in Prussia. It occurs also at Weardale, in Yorkshire, and in one or two other localities in England and Wales. It is valued exceedingly, from producing iron crystallizing in large plates, and known in commerce as *spiegel-eisen*. This iron contains certain proportions of manganese and carbon, which render it extremely valuable for steel-making. 2. The *clay*, or *black band ironstone* of the coal-measures, which consists of protocarbonate of iron associated with clay and carbonaceous matter. It is the principal ore of the Staffordshire and Scotch iron districts, where it occurs associated with the flux and fuel necessary for smelting it. Iron pyrites cannot be said to be an ore of iron in the strict sense of the word being only available as a source of sulphur and sulphate of iron.

Chemistry of Iron.—Iron yields, at least, four compounds with oxygen,—1. the *protoxide*, FeO; 2. the *sesquioxide*, or *peroxide*, as it is often called, Fe_2O_3; 3. the *black* or *magnetic oxide*, which is looked on by some chemists as Fe_3O_4, and by others as a compound of the protoxide and peroxide, $FeO+Fe_2O_3$; and 4. *ferric acid*, a weak metallic acid, only known in combination with the alkalies, FeO_3. The protoxide, FeO, has never been obtained in a pure state, and does not appear capable of existing in the anhydrous condition. It is precipitated as a white hydrate when a solution of potash is added to a solution of protosulphate of iron; the precipitate, however, rapidly absorbs oxygen from the air, passing first into the green hydrated magnetic oxide, and afterwards into the red hydrated sesquioxide. It forms well-marked salts with the acids. The *protonitrate of iron* is best prepared by decomposing the protosulphate with nitrate of baryta or lead. It forms a light-green solution, from which it crystallizes with difficulty *in vacuo*. If heat be applied, it deposits a basic salt of the peroxide. Its solution is much used in photography as a developing agent, from the greediness with which it absorbs oxygen. (*See* PHOTOGRAPHY.) The *protosulphate of iron*, which is also known by the names of *sulphate of iron*, *green copperas*, and *green vitriol*, is formed when iron or its sulphide is dissolved in dilute sulphuric acid. It is generally prepared from the sulphide, or iron pyrites, by first abstracting a portion of the sulphur by roasting, and then oxidizing the mass by exposure to the air and moisture: by this means oxygen is absorbed, which converts the remaining sulphur into sulphuric acid, and the iron into protoxide. The mass is exhausted with water, and the solution evaporated and crystallized. For chemical purposes, it may be obtained by dissolving 1 part of pure iron in 1½ parts of sulphuric acid diluted with 4 parts of water. It crystallizes in bluish-green rhomboidal crystals, containing 7 atoms of water. The sulphate of iron obtained in commerce has a grass-green colour, owing to a portion of pernitrate being present. Its solution has a strong affinity for oxygen, and is greatly used in photography as a developing agent. It is largely used in dyeing and in inkmaking; it also forms an important ingredient in medicines which are exhibited in cases of deficiency of iron in the blood. With the sulphates of the alkalies and manganese it forms double sulphates. At a strong heat it is decomposed into *colcothar*, or sesquioxide of iron, much used in polishing metals. The *protocarbonate of iron* occurs in nature as spathose ore and clay ironstone. The other proto-salts are unimportant. *Sesquioxide, peroxide*, or *red oxide* of iron, is obtained in a variety of ways, the best of which is by precipitating a solution of the sesquichloride by ammonia. It occurs abundantly in nature, and is much used in colouring glass. It is also extensively employed for the purpose of purifying coal-gas from sulphuretted hydrogen, with which it forms a protosulphide, which, when it ceases to absorb any more sulphuretted hydrogen, is reconverted into the sesquioxide for future use, by exposure to a current of air. It has also been applied to the purification of water. Sesquixode



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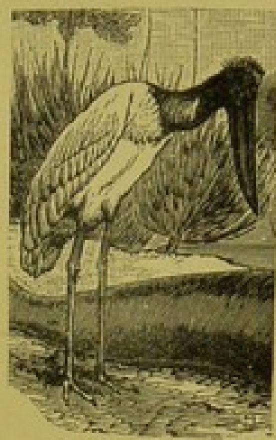

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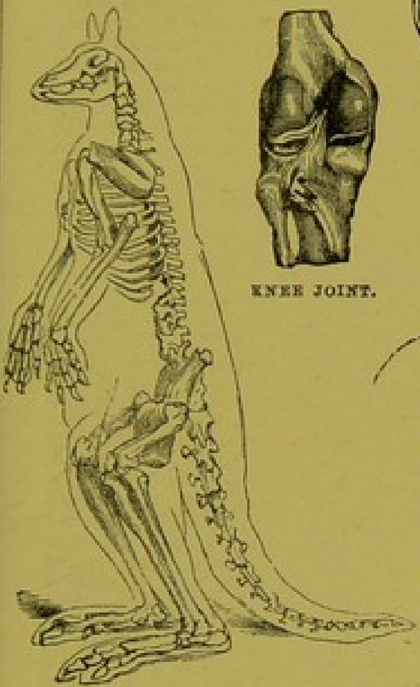
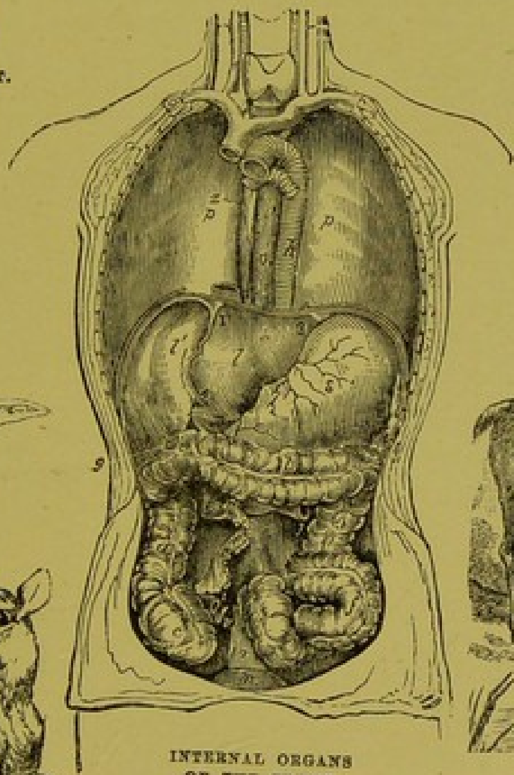


KNEE JOINT.

KANGAROO, SKELETON OF.

KINGFISHER.

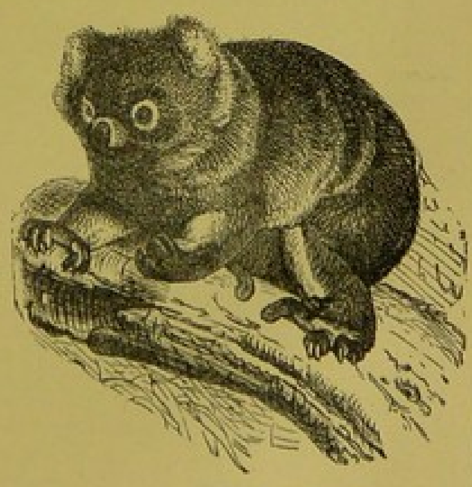


INTERNAL ORGANS
OF THE TRUNK.

KOODOO ANTELOPE.

KANGAROO.

LIVERWORT.



KOALA.

of iron, under certain circumstances, appears to exhibit feebly acid properties. The magnetic oxide is regarded by many as a compound of the protoxide and sesquioxide. Heated to whiteness, it forms the magnetic oxide. The sesquinitrate is formed by heating metallic iron in nitric acid. It is an unimportant salt, crystalizing in yellow four-sided, rectangular prisms. The sesquisulphate is obtained by heating a solution containing one equivalent of the protosulphate with half an equivalent of sulphuric acid, and adding to the solution nitric acid in small quantities, as long as red fumes are given off. A yellowish-white deliquescent mass is obtained. Sesquisulphate of iron, like the sesquisulphates of alumina and chromium, unites with the alkaline sulphates to form alums. The other sesquisalts of iron are unimportant. The *magnetic oxide*, *black oxide*, *ferroso-ferric oxide*, or *protosesquioxide*, as it is variously termed, occurs in nature as loadstone, and forms several very important ores of iron. It may be made by exposing fine iron wire to the action of steam at a red heat, or in a hydrated condition, by peroxidizing two parts of protosulphate of iron with nitric acid, to which is afterwards added one part of protosulphate. The whole is then poured into a solution of ammonia, with constant stirring. The hydrated oxide is of a green colour, and is attracted by a magnet The black oxide produced by heat contains a large proportion of magnetic oxide. *Ferric acid* has not been yet obtained in a separate state. The potash salt may be formed in solution by heating a mixture of one part of sesquioxide with four of nitre to full redness. A brown mass is obtained, which, when washed, gives a violet solution of ferrate of potash. With chlorine, iron forms two chlorides—the *protochloride*, which is made by passing dry hydrochloride acid over ignited metallic iron, when it sublimes in yellowish crystals. The sesquichloride is obtained by dissolving the sesquioxide in hydrochloric acid, from the solution of which it may be obtained in yellow scaly crystals, with five equivalents of water, or by passing chlorine over heated iron filings, which produces the anhydrous salt in brown scales. The impure solution has been greatly used as a sewage deodorizer. Iron forms two bromides, which are unimportant. Iodine combines with it in two proportions. Iron forms numerous compounds with sulphur, the only important ones being the *protosulphide*, FeS, and the bisulphide, FeS^2, or iron pyrites. The protosulphide is occasionally found in nature, but it is generally made by projecting into a red-hot crucible a mixture of thirty-two parts of iron filings and twenty-one parts of flowers of sulphur. It is largely used in the laboratory as a source of sulphuretted hydrogen. The *bisulphide* occurs abundantly in nature as iron pyrites, and is used exclusively as a source of sulphur and green copperas. The compounds of iron with phosphorus are unimportant, except as exercising a deleterious influence on metallic iron containing them. With carbon it forms one carbide, FeC_2; however, very small quantities of carbon exercise an important action in the formation of steel. Boride of iron has been obtained by reducing the borate by hydrogen, and silicide of iron is supposed to enter into the composition of *wootz*, or Indian steel. A nitride of iron has been obtained, as a white powder of uncertain composition.

Medecinal Use of Iron.—The compounds of iron salts, with the salts of the organic acids and bases, are numerous and important, being much employed in medicine. The citrate of quinine and iron, of ammonia and iron, and many others, form medicinal preparations much in vogue. Iron is taken into the human body in food and drink, and when it is insufficient in quantity, an addition, in the form of chalybeate waters, or in some other shape, is necessary. Iron compounds are the most valuable remedy in cases of anæmia, resulting from a reduction in number of the blood corpuscles The salts of iron are of great service in healing chlorosis and some painful nervous affections. Iron is prescribed in many forms, and its efficacy depends upon the readiness with which it is taken into the blood.

IRON BARK TREE.—In Australia this name is given to some species of the Eucalyptus, especially *E. resinifera*, on account of the extreme hardness of the bark.

IRONWOOD.—A name commonly given to the timber of trees of various species, on account of great hardness and weight; especially the *Metrosideras vera*, of the Eastern archipelago; the *Mesuaferrea*, a tree of the natural order *Guttiferæ*, a native of the East Indies; and the *Vepris undulata*, of the order *Diosmaceæ*, in South Africa.

IRRADIATION, *ir-rad-e-ai'-shun* (from Lat., *irradio*, I shine).—A term generally used to signify the apparent enlargement of the disc of a celestial body. In a more restricted sense, the word properly denotes the emission of rays from any luminous object. Irradiation, as an enlargement, is caused either by a deviation of the rays of light from a rectilinear direction, or by some illusion caused by the action of light on the eye. Objects which are of equal size, through the effect of irradiation often appear to differ in size: this effect depends either on their colour or the quantity of light which falls upon them. It was remarked by Sir William Herschel, that when a bright circle was viewed together with a dark one on a bright ground, the former always appeared larger than the other. (*See* DIFFRACTION.)

IRRATIONAL, *ir-rash'-o-nal* (Lat., *irrationalis*).—A term applied, both in Arithmetic and Algebra, to numbers or quantities whose roots are incommensurable with unity, and which cannot, therefore, be accurately extracted. Thus, the root of 2 is irrational, because it cannot be expressed by any finite number. If the side of a square be equal to 1, then the root of 2 will be its diagonal, and will consequently be irrational; for geometry teaches us that the diagonal of a square is incommensurable with its sides. In Algebra, irrationals are termed *surds*; and although they cannot be expressed in any finite numbers, yet close approximations can be made to their intrinsic values.

IRREDUCIBLE CASES, *ir-re-du'-si-bl* (Lat.), are those peculiar cases in the solution of cubic equations in Algebra, where Cardan's theory, or formula, fails in its application, on account of its imaginary expression. This unfortunate circumstance caused great difficulties to arise in the paths of early analysts; and even up to the present day all efforts may be deemed unsuccessful.

IRRITATION, *ir-ri-ta'-shun* (Lat., *irritatus*, provoked).—A morbid condition of the vital action, after producing remarkable sympathetic symptoms. Irritation of the stomach and intestines are most common and most important in their results, resembling in many cases inflammation of the peritoneum, pleura, or heart. Irritation of a calculus occasions intense sickness.

Irritability of Plants.—A term applied to the movements of the cilia, stamens, and other organs of some plants and to the shrinking from touch as in the case of the Sensitive Plant. The causes of these movement are as yet very imperfectly understood.

ISCHURIA, *is-ku-re'-a* (Gr., *ischo*, I retain; *ouron*, the urine).—A medical term denoting a retention of urine, and distinguished from dysuria in that, in the latter case, the discharge is attended with much difficulty, whereas in the former there is a total retention. They are both either acute, arising from inflammation, or chronic, from calculus, &c.

ISOBAROMETRIC LINES, *i-so-ba-ro-*

me'-trik (Greek, *isos*, equal; *barus*, heavy; *metron*, measure).—Lines marked on a map of physical geography, connecting those places on the surface of the earth which exhibit the same mean difference between the monthly extremes of the barometer.

Isoclinic Lines, *i-so-kli'-nik* (Greek, *klino*, to bend).—Lines showing the varying dip or inclination of the magnetic needle.

Isodynamic, *i'-so-de-nam-ik* (Greek, *dynamis*, force).—Lines showing the varying intensity of the magnetism of the globe.

Isogonic Lines, *i-so-go'-nek* (Greek, *gonia*, an angle).—Lines showing the varying declination of the needle from the true meridian.

Isothermal Lines (Gr., *isos*, equal; *thermos*, worm).—Lines marked on some maps to link together places where the average yearly temperature is similar. (*See* CLIMATE.)

ISOCHROMATIC LINES, *i-so-kro-mat'-ik* (Gr., *chroma*, colour).—When a pencil of polarized light is transmitted along the axis of a crystal, such as mica or nitre, and then received into the eye, after passing through a plate of tourmaline, coloured rings are perceived. To these coloured rings the term isochromatic lines has been applied. If between two plates of tourmaline, having their axes at right angles to one another, a plate of nitre be placed, having its surfaces perpendicular to the axis of the natural prism, and highly polished, and the system held close to the eye be turned towards the sky, or a sheet of white paper, there will be seen a series of oval rings about each of two points as poles. The curves receive their name from the circumstance that throughout each the tint is constant.

ISOCHRONISM, *i-sok'-ron-izm* (Gr., *isos*, equal; *chronos*, time), a remarkable property appertaining to all systems in equilibrium, by which, when slightly disturbed more or less, the oscillations resulting are all performed in the same time, or so nearly in the same time that any retardation or acceleration is imperceptible. When a pendulum, for instance, is allowed to vibrate till it rests, it will be found that no perceptible difference exists between the vibrations of longer or shorter extent, the same number of vibrations being made in the same length of time. Oscillations or vibrations performed in equal times are termed *isochronous* or *isochronal*; and *isochronal lines* are those along which a heavy body descends with a uniform velocity.

ISOMERIDES, ISOMERISM, *i-som'-e-ridz*, *i-som'-e-rizm* (Gr., *isos*, equal; *meros*, part). Isomerides are substances which have the same ultimate composition, but different properties, owing to their elements being grouped together in a different manner.

ISOMORPHISM, *i-so-mor'-fizm* (Gr., *isos*, equal; *morphe*, form.)—The property discovered by Mitscherlich, possessed by certain bodies of simillar composition, of crystalizing in similar forms. Substances possessing this property are found to be strangely allied in their chemical nature; and the fact of two bodies crystallizing in the same form has often led to the discovery of points of great similarity between them.

ISONANDRA, *i-son-an'-dra*.—A genus of trees, of the natural order *Sapotaceæ*. From the species *I. Gutta*, and other species, the valuable substance called gutta-percha is obtained. (*See* GUTTA-PERCHA.)

ISOSCELES TRIANGLE. (*See* GEOMETRY.)

ISOSTEMONOUS, *i-sos-tem'-o-nus* (Greek, *isos*, equal; *stemon*, a stamen).—A term applied to a flower in which the stamens are equal in number to the petals, or divisions of the corolla.

ISSUE, *is'-sue* (Fr., *issuer*, to go out; Lat., *fonticulus*, a little fountain).—In Surgery, an ulcer artificially formed, and kept open, so as to discharge matter, for the purpose of removing an unhealthy condition from some neighbouring part of the system. It is usually formed by making an incision through the integuments with a lancet, or other sharp instrument, sufficiently large for the insertion of one or more peas, which are retained there by a strip of adhesive plaster, so as to prevent the wound from healing, and keep up a state of constant irritation. The actual cautery and caustic potash are also employed in forming issues, being applied to the part till it sloughs, and the ulcer thus formed being kept open. A blister kept open by repeated renewals of the irritating matter, is an issue. Setons are another form of issue, made by passing a broad, flat needle, threaded with silk or other suitable substance, under a portion of the skin, and leaving the silk in the passage, with an end hanging out on each side.

ISTHMUS, *ist'-mus*.—A narrow neck of land joining two larger portions. The Isthmus of Suez, connecting Asia and Africa, and the Isthmus of Panama, between North and South America, are familiar instances.

ITACOLUMITE, *i-ta-kol'-u-mite*.—A micaceous, granular, quartz rock, found in Brazil, in which gold and topaz are associated.

ITALIAN MILLET. (*See* SETARIA.)

ITCH, *itsh* (Ang.-Sax.; Lat., *scabies*, from *scabo*, I scratch).—A disease of the skin, known also as scabies, characterized by an eruption of pustules or of small vesicles, the two being frequently intermixed, and accompanied by an intolerable itching; whence it derives its name. It has been divided into different classes; but the distinction is of no practical importance. It occurs chiefly about the fingers and the wrists and the flexures of the joints; but it may also attack other parts of the body, the face being the only part on which it never appears. It is caused by a minute insect—the itch-mite, or *Sarcoptes scabiei*—lodging under the skin, and is readily communicated by contact. The itch is never got rid of without medical treatment, and the great specific for its removal is sulphur. It is commonly used in the form of an ointment, smeared over the part once or twice a day, washing it carefully with soap and water before each fresh application. The cure usually takes from three to eight or ten days, according to the nature and extent of the disease. The disease is highly contagious, communicated by contact.

IVORY, *i'-vo-re* (Fr., *ivoire*).—The substance which composes the teeth or tusks of elephants. It has this peculiarity distinguishing it from the teeth of the hippopotamus, walrus, and some other large animals, that a transverse section shows lines of different colours, running in circular arcs, and forming at the points of crossing minute, lozenge-shaped spaces. Ivory is largely used in the arts for making or ornamenting a great variety of small articles in general use. The west coast of Africa and Ceylon are the districts from which the principal supplies of elephants' teeth to this country are obtained.

The Cape of Good Hope, Madagascar, Siam, and the coast of Barbary, also supply us with ivory. Fossil ivory is also sometimes exported from Russia to England. The trade in ivory has greatly increased of late years. This portion of the trade chiefly consists of wild elephants' tusks, which have been shed in the Arabian deserts, and bought up by the pacha of Egypt for sale in England. Although the ivory made from elephants' tusks is the best, considerable use is also made of the teeth and tusks of the hippopotamus, wild boar, and narwhal. The fossil mammoth of Siberia furnishes the Russians with a kind of ivory very similar to that furnished by the elephant of the present day. Mammoth tusks are sometimes obtained ten feet long, weighing nearly 170 lbs., and solid to within six inches of the end. The white keys of pianofortes are frequently veneered with this kind of ivory.

Vegetable Ivory, as it is called, is the seed of a genus of plants named *Phytelepha* (Gr., *phuton*, a plant; *elephas*, ivory), occurring in South America. The natives have used these seeds from time immemorial for making buttons, heads to walking-sticks, and various trinkets. It is only within a recent period that they have been brought to Europe. They are not so useful as ivory for delicate purposes; but they are used in the manufacture of a number of articles.

IVY, *i'-ve.*—A genus of plants (*Hedera*) of the natural order *Arabiaceæ*, shrubs and trees mostly natives of hot countries. The common ivy (*H. trelix*) is a native of the northern parts of Europe. Its peculiarity is that it clings to trees and walls by means of rootlets, which, in course of time (for the ivy is very long-lived), become as shrubs on the branches of small trees. The leaves are evergreen. The growth of ivy makes damp walls dry, by sucking out the moisture; but, from a similar cause, it injures trees round which it clings. A bitter principle found in a gummy exudation, and named *hederine*, has some value in medicine and as a varnish. There are other varieties of ivy, planted for ornamental purposes.

IXOLYTE, *iks'-o-lite.*—A mineral resin of a hyacinth-red colour, found in Austria, in amorphous lumps, amongst the tertiary lignites. It softens at 169° Fahr., and remains viscid at 212° Fahr.

J.

JABIRU, *jab'-i-ru.*—A genus of birds (*Mycteria*) closely resembling the storks and adjutants. They are natives of Africa, South America, and Australia. There are only a few species.

JACAMAR, *jak'-a-mar.*—A genus of birds (*Galbula*) belonging to the climbers. These brilliant birds are closely allied to the kingfishers, by their elongated, sharp, quadrangular bill, and by their short feet, but the toes have not the same formation exactly as in the kingfishers. The plumage is not so smooth as that of the kingfishers, and has always a metallic lustre. They live solitarily in humid woods, feed on insects, and build their nests on low branches. Most of the true jacamars are natives of tropical America. There are some found in the Indian Archipelago, whose bill, shorter, thicker, and a little bent, approximates them to the bee-eaters.

JACANA, *jak'-a-na.*—A genus of birds (*Parra*) of the order *Grallæ*, much resembling coots. The feet are not webbed, but the toes are so long that the bird can walk on the large leaves of the water-lilies and the weeds which cover the surface of lakes and swamps. Jacanas are natives of the warmer parts of Southern Asia, the Asiatic islands, Africa, and South America. The best known (*P. Jacana*), abundant in Guiana and Brazil, is about 10 inches long, mostly of a black colour, but with the back and wings of a bright chestnut hue. Other species, *P. Indica* and *P. Sinensis*, are found in India and eastern Asia.

JACARANDA WOOD, *jak-a-ran'-da.*—The name given to the timber of several trees of the genus *Jacaranda*, natural order *Bignoriaceæ*. From the agreeable odour it is also known as Rosewood. In Brazil some of the species are known as *Caroba*, and are reputed to possess medicinal properties.

JACK.—A fish. (*See* PIKE.)

JACKAL, *jak'-awl* (Arab., *tschakkal*; Fr., *chacal*), a species of the dog genus. The dental formula of the jackal is that of the dog. The pupil of the eye is round, like that of the dog and wolf. The colour of the Common Jackal (*Canis aureus*) is yellowish-grey above and whitish below; the thighs and legs are yellow, the ears ruddy; the muzzle very pointed; the bushy tail has a black tip. The height to the shoulder is about 15 inches. The jackal is gregarious in its habits, hunting in packs, frequently attacking the larger quadrupeds, but more commonly preying on the smaller animals and poultry. Its cry is very piercing and peculiar, and travellers describe it as being somewhat appalling when heard for the first time at night. Jackals are said to devour the corpses left on the field of battle, and to scratch away the earth from shallow graves, in order to feed on dead bodies. The belief that the jackal is the lion's provider probably arose from the notion that the piercing cry of the pack gives notice to the lion that prey is on foot. The disagreeable odour of the jackal is one of the reasons why it has not been reduced to a state of domesticity. It interbreeds, however, with the common dog; its period of gestation is the same, and the hybrid progeny is fertile. The jackal is an inhabitant of India, and other parts of Asia and Africa. It is believed by some that the three hundred foxes between whose tails Samson is said to have put firebrands, in order that they might set fire to the crops of the Philistines (Judges xv. 4, 5), were jackals.

JACKASS, LAUGHING, *jak'-ass.*—A name commonly given in Australia to a bird of the kingfisher kind (*Dacelo gigantea*), belonging to the *Halcyonidæ*. It resembles the kingfisher in appearance, but not in habits, living on insects, reptiles, and other small animals. The peculiar cry was the origin of the popular name. It is easily domesticated, and is of value as a destroyer of insects and reptiles. It is of a brown colour and about 18 inches long.

JACKDAW, *jak'-daw.*—A common English bird (*Corvus monedula*) of the crow kind, very much resembling the rook, particularly in its sociability. Jackdaws live together in considerable numbers throughout the year, and, whether seeking for food or rearing their young, they always appear to live in perfect harmony. The length of the jackdaw is about thirteen inches, with a black bill and white eyes; the hinder part of the head and neck of a hoary-grey colour; the rest of the plumage of a rich glossy black above, beneath dusky; the legs are black. The jackdaw is much more bold and familiar than the rook, and there is more activity in its movements. Cultivated districts are preferred by jackdaws, and they frequent and build in church towers, belfries, and steeples, their nests being very elaborately constructed. The female lays from four to six eggs; these are usually produced in May, and the young are hatched by the end of the month, or early in June. The eggs are of a pale bluish-white, spotted with ash-colour and clove-brown. The young birds are easily tamed, and become much attached to those who feed them. Very soon they begin to imitate the sounds of the human voice, and exhibit other amusing qualities. These birds are not particular as to the quality of their food eating, indiscriminately insects, seeds, grain, eggs, or carrion; on the sea-shore shell-fish, or the remains of other fish, and crustacea. Jackdaws are notorious thieves, not only stealing food, but appearing to have a particular predilection for shining substances, as money, &c. They carry this little weakness so far that it is said they have been known to purloin spectacles from persons who were in the act of reading. Ingoldsby's version of an old ecclesiastical legend, "The Jackdaws of Rheims," is well known. The jackdaw is not only found in this country, but also further north, in Denmark and Scandinavia, in Russia, Western Siberia, and Iceland. It does not exist in America, but is to be found in Southern Europe, the Mediterranean islands, and parts of Northern Africa.

JACK-FRUIT. (*See* ARTOCARPACEÆ.)

JACOB'S LADDER.—A perennial plant (*Polemonium cæruleum*), of the natural order *Polemoniaceæ*. It is a native of central and southern Europe and of parts of Asia and North America. It is cultivated in this country as an ornamental plant. It grows to a height of about two feet, and the flowers are of a bright blue or white colour. At one time it was esteemed valuable in medicine.

JADE is the common name loosely applied to several minerals, such as nephrite, serpentine, and axestone. Jade nephrite chiefly consists of silica, magnesia, and lime. Its closeness of structure and susceptibility of taking a high polish cause it to be used as an ornamental stone. It is tough, translucent, and of about the hardness of quartz. In colour it is bluish, light green, or flesh-tinted.

JAGUAR, *jag'-war*.—The American panther (*Felix onça*), the form of the leopard found in the New World. The form of the jaguar is robust, stouter than the leopard, and strongly and almost clumsily built. The body is thicker, the limbs shorter and fuller, and the tail barely reaches the earth when the animal stands well upon its feet. The head is larger and somewhat shorter than that of the leopard, and the profile of the forehead is more prominent. The animal, when full grown, is said to measure from four to five feet from the nose to the root of the tail. On the whole of the upper part of the body it is of a bright-yellowish fawn-colour, which passes, on the throat, belly, and inside of the legs, to a pure white. Upon this ground, the head, limbs, and under-surface are covered with full black spots of different sizes; the rest of the body is covered with annular patches, either having a black point in the centre, or formed of small black spots arranged in a circular form. The jaguar is a native of South America—Paraguay and the Brazils principally; but it is said to have been met with in all parts of the Isthmus of Darien and the southern extremity. The jaguar is the terror of the inhabitants of the countries which he infests. None of the living quadrumana or quadrupeds seem to come amiss to its voracious appetite, and it devours with relish birds, fish, and even reptiles. It can climb the smoothest stemmed trees, and move with great agility among the branches, and even monkeys sometimes become its prey. Notwithstanding all this ferocity, the jaguar seldom attacks the human race, though he will not shun man when he meets him. His favourite prey seems to be the larger quadrupeds, such as oxen, horses, sheep, and dogs, which he attacks indiscriminately, and in the same treacherous manner as the rest of the *Felidæ*. When he has made choice of a prey, he springs on its back, and placing one of its paws upon the back of the head, whilst he seizes the muzzle with the other, twists the head round with a sudden jerk, dislocating the spine, and thus killing his victim at once. The inhabitants of South America hunt the jaguar in various ways, either with a pack of dogs or by means of the lasso; the latter mode, however, can only be adopted upon plains or open grounds. There is a black variety of the jaguar,—*le jaguar noir* of the French.

JALAP, *jal'-lap* (from Chalapa or Xalapa, its native place). (*See* IPOMŒA.)

Jalapin, *jal'-ap-in*.—A resin, insoluble in ether, found in jalap, and supposed to constitute the purgative principle of that substance. It is also called *convolvulin* and *rhodeoretin*.

JAMES'S POWDER, a compound of phosphate of lime and antimony, patented by Dr. Robert James in 1765.

JANIPHA. (*See* MANIHOT.)

JANTHENA, *jan-thee'-na*.—A genus of gasteropodus molluscs, of the same family with the Ear-shell. They are very numerous in the Mediterranean.

JASMINACEÆ, *jas-min-ai'-se-e* (Arab., *jasmen*, jasmine).—The Jasmine family, a natural order of *Dicotyledones*, in the sub-class *Corolliflorœ*. Shrubs often twining and many having very fragrant flowers. There are about 100 species. The *Jasminaceæ* are chiefly natives of the East Indies; but a few species are found in other warm regions of the globe. The *volatile oil of jasmine* used in perfumery is chiefly obtained by distilation from the flowers of *Jasminum officinale* and *grandiflorum*. The leaves of some species are very bitter, and have been employed medicinally. The flowers of the species *Nyctanthes arbor-tristis* are used in India for dyeing yellow.

JASPER, *jas'-per* (Gr., *iaspis*).—A mineral of the quartz family, occurring in the form of rocky masses, often making up large portions of hills of considerable size. In hue, it is of various shades of red, yellow, brown, and green, sometimes arranged in stripes, when it is called ribbon jasper. Its varied colours are generally derived from iron in different degrees of oxidation. Jasper is much used for ornamental purposes, on account of its hardness and susceptibility of taking a high polish. Bloodstone, or heliotrope, is a deep-green variety of jasper, with blood-red spots. Touchstone is a velvet-black flinty variety, used for testing the purity of gold alloys. The alloy is rubbed on the stone, so as to leave a metallic streak, and the quality is estimated by the brightness of the colour when nitric acid is washed over it. The principal deposit of jasper is the gorge of the Korgon, in Siberia; and one of the best known kinds is found in Egypt.

JATEORHIZA, *jat-e-o-ri'-za.*—A genus of the natural order *Menispermaceæ.* The root of the species *J. palamata,* sometimes named *Cocculus palmatus,* forms the calumba of the Materia Medica. (*See* CALUMBA.)

JATROPHA, *jat'-ro-fa* (Gr., *iatros,* physician; *trophe,* food, in allusion to the medicinal properties of the plants).—A genus of plants belonging to the natural order *Euphorbiaceæ.* The seeds of *J. purgans* and those of *J. multifida* are called physic-nuts. They yield by pressure fixed oils, and both the oils and seeds are drastic carthartics. The oil of *J. purgans* is commonly known as *oil of wild castor-seeds,* or *Jatropha oil,* and is well adapted for burning. It is sometimes employed to adulterate East-Indian croton oil. The seeds of *J. gossypifolia,* called bastard French physic-nuts, also possess purgative properties.

JAUNDICE, *jawn'-dis* (Fr., *jaunisse,* from *jaune,* yellow).—The name of a disease characterized by yellowness of the skin and eyes. It is usually preceded by symptoms of a disordered state of the liver and digestive organs, as loss of appetite, irregular bowels or constipation, colic pains, nausea, headache, languor, &c. Sooner or later, the yellow colour begins to appear, usually first in the eye, then the face, and then the whole body. Sometimes the yellowness is the first symptom. The urine is very dark coloured, and usually loaded with biliary deposits, and the fæces are almost white, or of a light drab colour. From the time of the appearance of the yellow hue, many of the preliminary symptoms may diminish. The shades of yellowness are various, from a light yellow to a deep orange hue, and in some cases greenish, or even almost black, when it is known as green or black jaundice. Jaundice arises from the excretion of bile being prevented and retained in the blood, or re-absorbed and diffused throughout the system. It depends upon various and different internal causes. Any kind of pressure upon the excretory ducts will occasion it, as by tumours, &c.; by the ducts being plugged up by mucus, inspissated bile, or biliary calculus. Fits of anger, fear, alarm, &c., have sometimes been directly followed by jaundice. It may also occur as a symptom of acute or chronic inflammation of the liver, originating in the drinking of ardent spirits, or of inflammation of the ducts which, being of small size, are readily closed up by an inflammatory swelling of the mucus membranes. A high atmospheric temperature long continued has also a decided influence in producing certain forms of this disease; and blood-poisoning by copper or mercury, the bite of serpents, or attacks of violent fever, will also produce it. In general, we may expect a favourable termination of this disease, except when it depends upon structural disease of the liver, or supervenes suddenly upon some great mental or bodily shock. The greenish or darkish varieties are the most dangerous. The course and duration of this disease are various, in some cases disappearing or proving fatal as early as the fourth day; in others continuing for months or years. Some kinds of jaundice are absolutely irremediable; others will pass away without any treatment. In general, the obvious treatment is to promote the secretion of the bile and to favour its removal. A mild diet and the avoidance of all stimulants are strictly enjoined.

JAY, *jai* (Fr., *geai*; Sp., *gayo*).—A bird belonging to the family of the *Corvidæ,* order *Insessores.* It is a very handsome bird; and the common jay (*Garrulus glandarius*) is well known in most of the well-wooded districts of England. It feeds on vegetable productions, such as acorns, berries, beech-mast, and other similar substances. The jay is about thirteen inches in length, and its general colour is a light purplish buff, finely tinged with red; a black tail; on each wing a mottled patch with bright blue marking, and the head is surmounted by a crest of erectile feathers. It has a fine note, but is more remarkable for its power of mimicry. Even a sound so different from that usually produced by a bird as the neighing of a horse, is imitated with wonderful resemblance. The nest is beautifully constructed; and the eggs, five or six in number, are nearly white, with brown specks. The jay is easily domesticated. Besides being common in England, the jay is also found scattered over most parts of Europe; and in America there is also a variety termed the blue jay (*Garrulus cristatus*), which is very common in the northern portions of that continent.

JELLY-FISH, a general term applied to the Medusa, or that division of the class *Acephalæ* called *Discophora* or *Palmagrada.* All the animals belonging to it are entirely gelatinous, consisting of a large hemispherical disc, more or less convex above, and closely resembling a mushroom or umbrella in shape. (*See* MEDUSA.)

JERBOA, *jer'-bo-a.*—A genus of rodent quadrupeds (*Dipus*), of the family *Aruridæ.* The hind-legs are very long, and the fore-legs very short, on account of which peculiarity the ancient Greeks named them *dipous,* two-footed. The tail is long and tufted. Although small animals, they can leap, kangaroo fashion, three or four yards. They inhabit deserts and grassy plains in Asia, the east of Europe, Africa, and Australia, are nocturnal, hiding in burrows in the day-time. They are very destructive to grain and other crops, laying up stores for food in winter. The flesh is eaten, and resembles that of a rabbit.

JER-FALCON. (*See* GER-FALCON.)

JERUSALEM ARTICHOKE. (*See* ARTICHOKE.)

JERVIN, *jer'-vin.* — A white crystalline fusible base, found, along with veralin, in the *Veratrum album,* or white hellebore.

JESSAMINE. (*See* JASMINE.)

JESUITS' BARK. (*See* CINCHONA.)

JEW'S EAR. (*See* EXIDIA.)

JOB'S TEARS.—The popular but not easily explained name of a corn plant of India (*Coix lachryma*). The hard, shining seeds are of a bluish-white colour, and are fancifully compared to tears. They are sometimes made into necklaces and beads. As a cereal the plant is of a very inferior kind.

JOHN DORY. (*See* DORY, JOHN.)

JONESIA, *jo-ne'-si-a.*—A genus of trees of the natural order *Leguminosæ*, natives of eastern countries. One very beautiful species, *J. Asoca*, having orange and crimson flowers, is frequently referred to in Indian poetry.

JONQUIL, *jon'-kwil.*—A species of Narcissus. The common and the sweet-scented jonquils are natives of the south of Europe. Perfumes are made from jonquil flowers.

JUDAS'S TREE.—The popular name of a genus of trees of the natural order *Leguminosæ*. There is an ecclesiastical tradition that Judas Iscariot hanged himself on a tree of this species. One species is a native of South Europe, and the temperate parts of Asia; and there is a Canadian species. The timber is beautifully veined, and takes a high polish.

JUGLANDACEÆ, *ju'-glan-dai'-se-e* (from Lat., *Jovis glans*, the nut of Jupiter, on account of its excellence).—The Walnut family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*. (*See* WALNUT.)

JUGULAR VEINS, *jug'-gular* (Lat., *jugulum*, the neck). The name given to the veins which run down the sides of the neck, and carry the blood downwards from the head. They are divided into external and internal; the two afterwards uniting and going with the subclavian vein to form the superior *vena cava*, which terminates in the superior part of the right auricle of the heart.

JUJUBE, *ju-jube'* (Arab.)—A term properly applied to the fruit of *Zizyphus vulgaris* and *Z. Jujuba*, closely resembling a small plum, and sometimes used as a sweetmeat. The trees, of which there are many species, are spring and deciduous shrubs or small trees, are natives of the South of Europe, Eastern Asia, Africa, South America. The Lotus tree belongs to this family (*see* LOTUS), and the *Z. Spina Christi*, is traditionally asserted to be the plant from which Christ's crown of thorns was made.

JUNCACEÆ, *jun-kai'-se-e* (Lat., *juncus*, a rush).—The Rush family, a natural order of *Monocotyledones*, sub-class *Petaloideæ*—sedge or grass-like herbs, with tufted or fibrous roots. The *Juncaceæ* are found chiefly in cold and temperate climates, but a few inhabit tropical regions. There are 19 genera and 200 species.

JUNE, *june* (Lat., *Junius*).—The sixth month in the year, which was formerly the fourth among the Romans. It is supposed to have derived its name from the Latin *juniores*, young persons, as the preceding month of May was taken from *majores*, elders, or old persons. By some the month is said to be named after Juno, the wife and sister of Jupiter and queen of heaven. It consists of thirty days. The Anglo-Saxons named it Sear-monath (dry month), and Midsumer-monath.

JUNGERMANNIACEÆ, *jun-ger-man-ne-ai'-se-e* (after the German botanist Jungermann).—The name given to a sub-order of the Diverworts or *Hepaticaceæ* (which *see*). They are usually called scale-mosses.

JUNGLE-FOWL, *jung'-gl.*—A species of birds *Megapodius tumulus*, belonging to the family of the *Megapodidæ* (large-footed), and its order *Gallinæ*, peculiar to Australia, where they were first discovered. The jungle-fowl is about the size of a common fowl, and the mounds which it rears for the purposes of incubation are said to be very large. In some instances they have been seen fifteen feet high, and are sixty feet in circumference at the base. Mr. Gould, in his description of the birds of Australia, says that it is almost exclusively confined to the dense thickets immediately adjacent to the Nathur, and that it appears never to go far inland. It is always met with in pairs, or quite solitary, and it feeds on roots, berries, and insects. The head and crest of the jungle-fowl are of a deep cinnamon-colour, while the back of the neck and all the under surface of the body are a very dark grey; the bill is a reddish-brown, and the tarsi and feet a bright orange. The Jungle-fowl of India is a very different bird.

JUNGLY GAW, *jun'-gle gaw.*—A species of ox (*Bos Sylhetanus*), a native of the north-east of India. It is very like the domesticated ox in appearance. The milk of the cow is abundant and of fine quality.

JUNIPER. (*See* JUNIPERUS.)

JUNIPERUS, *ju-nip'-e-rus* (Lat.).—A genus of plants belonging to the natural order *Coniferæ*, sub-order *Cupressineæ*. The species *J. communis*, the common juniper, is a bushy shrub with evergreen sharp-pointed leaves. It grows in all the northern parts of Europe, in fertile or in barren soils, on hills or in valleys, on open sandy plains or in moist and close woods. In the south of Europe it is only found in elevated situations: it abounds in the Alpine region of Switzerland. All parts of the plant, when bruised, exhale a more or less agreeable terebinthinate odour. The fruits and young tops are used in medicine, having stimulant and diuretic properties. The volatile oil (*oleum juniper*), obtained from the fruits and other parts by distillation with water, is officinal in our Pharmacopœias. The fruits or berries are used to flavour gin and Hollands. (*See* GIN.) They are imported from the northern countries of Europe. Juniper-wood has a reddish colour, and is used occasionally for veneers. The species, *J. Oxycedrus* yields, by dry distillation, the tarry oil known in France as *huile de cade*: it is principally used in veterinary medicine. The timber of this species is very durable. *J. Bermudiana* is the red or pencil cedar, and *J. Virginiana* the Virginian red cedar. The wood of these species is used for pencils; that of the former is considered the best. The wood of the latter is used for lining cabinets, the fragrance keeping away moths and other insects. *J. Sabina*, the common savin, is another interesting species: it is a native of the midland parts of Europe, and forms a small bushy shrub. The young branches, which are completely enveloped in the small imbricated leaves, are officinal in our Pharmacopœias. They, and the oil obtained from them, have acrid, stimulant, diuretic, emmenagogue properties. In large doses they are irritant poisons. Savin ointment is a useful acrid application to keep open blistered surfaces.

JUNO, *ju'-no* (Lat., *Juno*).—One of the asteroids, a group of small planets that revolve in orbits between those of Mars and Jupiter. (*See* ASTEROIDS.) It was discovered by a German astronomer, Herr Harding, of Lilienthal, on Sept. 1, 1804. It holds the third place among the asteroids in order of discovery, and the fourth in point of size, being 1424 miles in diameter. Its mean distance from the sun is about 254,000,000 miles, and it accomplishes its revolution around that body in 4 years and 132 days.

JUPITER, *ju'-pit'-er* (Lat., *Jupiter*).—The sixth of the greater or primary planets, reckoning them in order from the sun, and including the planet Vulcan, which was discovered between Mercury and the sun in 1859. It is the largest of all the heavenly bodies in our solar system, with the exception of the sun itself. Its diameter is calculated to be 84,850 miles, while its mean density is about one-fourth that of the earth, or 1·42 when compared with the density of an equal bulk of water represented by unity. The shape of the planet is that of an oblate spheroid; its polar diameter, or the length of its axis of revolution, being 85,300 miles, which is, to its equatorial diameter, very nearly in the proportion of 16 to 17. The mean distance of Jupiter from the sun is calculated to be 475,692,000 miles; it accomplishes its revolution about its own axis in 9 hours 55 minutes, and its revolution round the sun in 11 years 217 days. The inclination of its orbit to the ecliptic is about 1° 19′, while the inclination of its equator to the ecliptic is 3° 5′ 30″. When viewed through a telescope, the planet seems to be surrounded by several narrow bands or belts of a dark colour, which are parallel to each other and its equator. Astronomers differ as to the cause of this singular appearance; but it is supposed to arise from the presence of dense masses of cloud about the planet. Jupiter is accompanied by four satellites or moons, which revolve about it in the same manner as the moon revolves about the earth. The following table shows the approximate time of revolution of each satellite about the planet, with its distance from the planet and its diameter in miles:—

Satellites.	*Period of Rev.* Days.	Hours.	*Mean Dist.* Miles.	*Diam.* Miles.
1	1	18·466	272,250	2,430
2	3	13·233	435,600	2,180
3	7	3·710	694,250	3,560
4	16	16·533	1,225,125	3,045

All the satellites, with the exception of the fourth, suffer an eclipse in each revolution round the planet. The eclipses of the satellites of Jupiter, especially of the first, afford the means of determining the longitude of any place on the earth's surface, and the time at which any eclipse of Jupiter's satellites commences is consequently registered in the "Nautical Almanac" for the guidance of sailors, the time named therein being the hour at which the eclipse would commence at Greenwich, if visible there. Now, at whatever parts of the earth these eclipses are visible, they are always seen by observers at exactly the same moment of time, in consequence of the great distance of Jupiter from the earth (91,430,000 miles). The observer, wherever he may be, has merely to note the exact time at which the eclipse commences when viewed from his position, and then refer to the "Nautical Almanac" to ascertain the time at which it commences at Greenwich. The difference between the times when reduced to degrees and minutes, an hour of time corresponding to 15 degrees of space, will show the longitude of the observer's position. (*See* LONGITUDE.) The velocity of light is discovered by means of observations of Jupiter's satellites by Römer.

JURASSIC FORMATION. (*See* GEOLOGY and OOLITIC SYSTEM.)

K.

KAAMA, OR CAAMA, *ka-a'-ma*.—A species of antelope of South Africa, the Hartebeest of the Dutch colonists. (*See* ANTELOPE.)

KALE, OR BORECOLE, (Ger., *kohl.*)—A plant of the cabbage kind, but differing in the open heads of leaves. It is a cultivated variety of *Brassica oleracea*. (*See* BRASSICA.)

KAKODYL. (*See* CACODYL.)

KALMIA, *kal'-me-a* (so named from Peter Kalm, the Swedish traveller).—A genus of evergreen shrubs, belonging to the natural order *Ericaceæ*. The species are beautiful shrubs, and belong to the class of ornamental plants commonly called American. The red or white flowers are very beautiful. At the horticultural shows they are always exhibited with rhododendrons and azaleas. *K. latifolia*, a native of North America, where it is known as the mountain lamet or calico bush, grows to the height of 10 feet. The leaves are poisonous; but a decoction is sometimes used as a remedy for skin diseases.

KALONG, *ka'-long*.—A species of fruit-eating bat, a native of Java; and the name is also frequently applied to other species of fruit-eating bats. (*See* BAT and PTEROPUS.)

KAMALA. (*See* ROTTLERA.)

KAMSIN. (*See* SIMOOM.)

KANGAROO, *gan-ga-roo'*.—The common name of an extensive family of animals, distinguished by the female having no *placenta*, and by their young being nursed in a peculiar pouch in the body of the mother. (*See* MARSUPIALIA.) The scientific term *Macropus* is also used to designate the same family, which varies much in appearance and habits. Some are carnivorous, whilst others live on vegetables. They are nearly confined to Australia, and are characterized by a very low degree of intelligence. The phalangers form a sub-family, having the second and third toes so completely included within the skin as to appear like a single toe, were it not for the claws, which project distinctly. They are covered with a close, thick, soft fur, and live on trees and bushes. They have a strong prehensile tail, with which they hook themselves to the branches upon which they doze during the day. They give out a very strong odour, but their flesh is eaten. In the genus *Cuscus*, the tail is long, scaly, and rat-like, and the ears are short. In the genus *Petaurus*, the skin of the body is expanded between the anterior and posterior limbs, which enables the species to leap from one tree to another. Four or five species are known, of which the most familiar is the flying squirrel of Norfolk Island. The genus *Phascolarctos*, or koala, bears some resemblance to the phalangers, but has no tail. The *Macropina*, or kangaroos proper, have the tarsus and middle toe of the hind foot elongated, and the two inner ones rudimentary, equal, and united together. This genus has very large posterior limbs, and the tail is of remarkable length and strength. This organ is of great importance to the animal, since it is used as an organ of locomotion, a weapon of offence, and also as a third point when the kangaroo rests on its haunches. It also assists in the astonishing leaps which these animals continually take when moving about. Their progress actually consists of a series of springs, sometimes twenty feet in length. They seldom stand on all-fours, except when feeding, and are harmless and inoffensive creatures. The *Macropus major*, or great kangaroo, is the largest species. It measures about seven feet from the tip of the nose to the end of the tail, and, when sitting, appears about the height of a man. The kangaroo forms an important article of food, and the flesh is represented by those who have tasted it as being a little like venison. Soup made of the tail is said to be far superior to the ox-tail soup of Europe. Individual specimens have been brought alive into this country, and have been successfully kept in some of our parks. The great kangaroo inhabits New South Wales, Southern and Western Australia, and Tasmania. Other genera, the *Lagorchestes*, or kangaroo hare, and the *Hypsiprimnus* (*see* KANGAROO RAT), are also found in Austrialia. The *Dasyurina*, or opossums, which also belong to the kangaroo family, are found in America and the West Indies. (*See* OPPOSSUM, MACROPIDÆ.)

KANGAROO GRASS.—An excellent fodder-grass of Australia (*Anthis tria Ausholes*). It is very tall and affords abundant herbage.

KANGAROO RAT (*Hypsiprimnus*).—A marsupial animal found in Australia. It is the size of a rabbit, colour greyish, reddish-brown above, whittish below; it feeds upon vegetables, and it is said to burrow in the ground.

KAOLIN, *kai'-o-lin* (Chinese).—A pure white clay, resulting from the decomposition of felspar in granitic rocks. It was originally found in China, but has been discovered near St. Austle in Cornwall, and at St. Yrieix, near Limoges. It consists of nearly pure silicate of alumina, with small quantities of oxide of iron, potash, and water. It is used for making the finer kinds of porcelain.

KARENGIA, *ka-ren'-ji-a.*—A grass (*Pennisetum distichum*), a native of Central Africa, and very similar to millet. On the southern border of the Sahara it is much used as food.

KARPHOLITE, *kar'-fo-lite* (Gr., *karpho*, I dry or shrivel; *lithos*, a stone).—A mineral which occurs in minute crystals and in stellated silky fibres. It consists principally of silica, alumina, and oxide of manganese. In colour it is straw-yellow; is able to scratch fluorspar, and is scratched by felspar. The lustre of the crystals is vitreous, and that of the fibres silky. Before the blowpipe, karpholite fuses into a dark glass, which becomes darker in the interior flame.

KAT, OR KHAT. (*See* CATHA.)

KATTIMUNDOO, *kat-te-mun-doo'.*—The milky juice of the *Euphorbia nereifolia.* It is used in India as a cement.

KATYDID, *ka'-te-did.*—A species of grasshopper (*Platyphyllum concavum*), a native of North America. It is of a pale-green colour. The name is taken from the peculiar note which resembles the articulation of the three syllables.

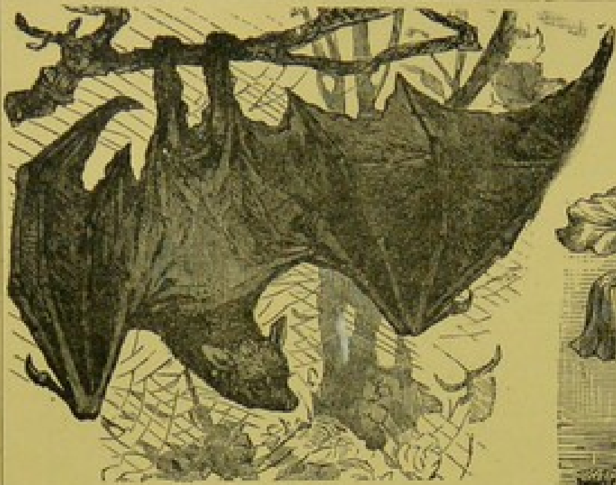
KAWRIE PINE. (*See* DAMMARA.)

KENTISH RAG.—A dark-coloured, calcareous sandstone, found in beds 70 or 80 feet thick, in the lower greensand measures on the coast of Kent.

KEPLER'S LAWS, *kep'-lers.*—The term applied by astronomers to the statement of certain analogies that exist between the relative distances of the planets from the sun and the times in which they complete their revolution round that body; and also between the rate of motion at which any heavenly body travels in its orbit, and its distance from the body or centre about which it revolves. Kepler's first law is that "planets describe ellipses, having the sun as a common focus." The second law is that "equal areas are described in equal times." By this it is meant that if a straight line were drawn from the earth to the sun, round which the earth revolves, this line would pass over equal portions of the area of the ellipse which the earth describes in its orbit in equal times, wherever the planet might be in its course. Kepler arrived at this conclusion from observing that the planets travelled fastest when they were nearest to the sun, at their perihelion, and slowest when they were at their aphelion, or greatest distance from that body; while his third is that "the squares of the periodic times of the planets are in proportion to each other as the cubes of their own mean distances from the sun."

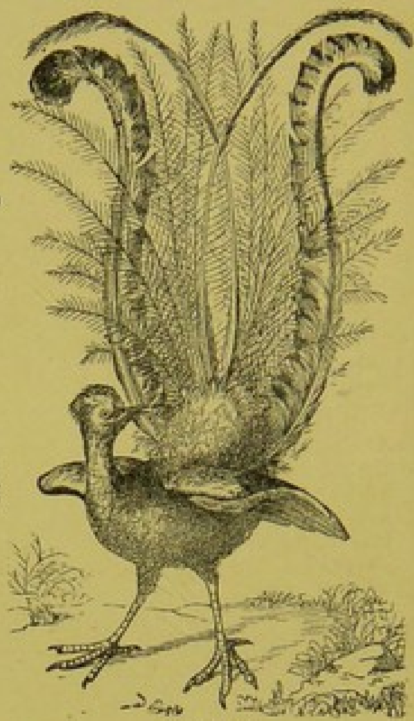
KERMES, *ker'-mes.*—An insect of India and Persia, which attaches itself to the leaves of a stunted species of oak. It bears some resemblance to the cochineal, and a dye-stuff, known as scarlet grain, is obtained from the bodies of the females.

KESTREL, *kes'-trel* (Ang.-Nor.)—One of the most common species (*Falco tinnunculus*) of the British *Falconidæ*. It is elegant in shape, attractive in colour, and graceful in its movements through the air, and is best known by its habits of sustaining itself in the air in the same place by means of a short but rapid movement of its wings. The kestrel is also called the wind-hover, from this habit of remaining suspended in the air. Although the kestrel lives principally on mice, it also attacks and devours small birds. The kestrel frequently takes possession in spring of the nest of a crow or magpie in which to deposit its eggs. Sometimes, however, it builds in high rocks or old towers. It lays four and occasionally five eggs. The kestrel is found in nearly all parts of the world. In length it is from thirteen to fifteen inches, dependent upon the sex. In the male, the beak is blue, pale towards the base; the top of the head and nape of the neck ash-grey, with dusky streaks; the back and wing-coverts reddish-fawn colour, with small, black triangular spots, one occupying the point of each feather; the tail-feathers are ash-grey, with a broad black band near the end, each feather being tipped with



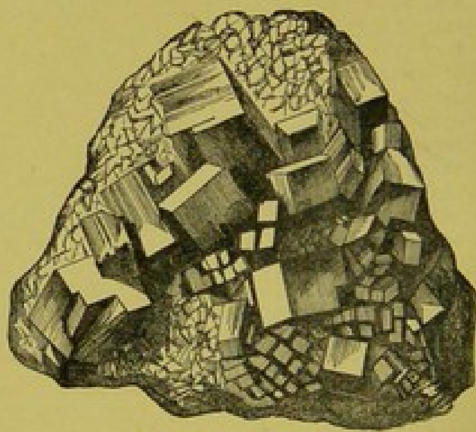
KALONG.

LOTUS.



LYRE-BIRD.

KINKAJOU.



SULPHATE OF LEAD.

LOCUST-TREE.

LION.

white; the breast and belly are pale rufous fawn-colour, with streaks on the former and dark spots on the latter; the legs and toes are yellow, and the claws black. The colour of the female differs little from that of the male, the under surface of the tail feathers of the former being more uniform in colour, and less distinctly barred than in the male.

KEUPER. (*See* TRIASSIC PERIOD.)

KHAYA, *kay'-a.*—A genus of trees of the natural order *Cedrelaceæ.* *K. Senegalensis,* or the Kasson-Khaye of Senegal, is a very tall tree, valued for its hard, finely grained timber. The bark is used as an astringent and febrifuge.

KIDNEY, *kid'-ne* (Ang.-Sax.; Lat., *ren*).—The name of a double gland, having for its office the secretion of the urine. The form of the kidney resembles that of a French bean; its average length being from four to four and a half inches, its breadth two inches, and its thickness one inch. The two kidneys are situated in the lumbar region, one on each side of the spine, on a level with the last two dorsal and the first two lumbar vertebræ; they are of a brownish-red colour, flattened from before backwards, and grooved on the interior border for the great vessels. They are covered by a thin, firm, transparent cellular envelope; and internally are composed of two substances—an exterior or cortical, and an interior or medullary. The cortical substance is the seat of the greater part of the secretory process, and is made up of a great number of uriniferous tubes, much convoluted, and inosculating with each other, and lined with epithelial cells of a spheroidal and projecting form. Scattered through the plexus formed by these tubes and the blood-vessels, are dark points, which have been called *corpora Malpighiana,* from their discoverer. These last are convoluted masses of minute blood-vessels included in flask-like dilations of the uriniferous tubes, forming a close relation between the circulating and secreting systems. The medullary substance is composed principally of tubes passing nearly straight inward to the central receptacle of the secretion. Both substances are imbedded in interlacing fibres, most abundant in the medullary. The kidneys are well supplied with blood-vessels and nerves, in accordance with the importance of their function. The renal arteries come directly from the aorta, and the large veins terminate in the vena cava. The nerves come from the renal plexus. The renal arteries divide, soon after entering the organs, into minute twigs, which pierce the capsule of the Malpighian tufts. From the convolutions of these tufts arise the efferent vessels, which surround the uriniferous tubes, and from which the renal veins are formed; and thus the urinary secretion is produced from blood which has passed through the Malpighian capillaries.

Diseases of the Kidney.—The kidneys are subject to a variety of dangerous and painful diseases, arising from various causes. They may be arranged in two distinct classes—those which are the result of some cause acting locally, as calculi, retention of urine, or a blow on the loins; and those which are the result of a constitutional cause acting upon the kidney by inducing an abnormal condition of the blood. (For disease of the kidney arising from renal calculi, *see* CALCULUS.) Inflammation of the kidneys (nephritis) is characterized by pain in the lumbar region, often extending anteriorly through the abdomen, or descending to the groin and testes, with retraction of the latter, disordered state of the urinary secretion and excretion, febrile disturbance, sometimes numbness of the thigh, and nausea or vomiting. The whole of these symptoms are not always present, except in some of the more severe cases. Inflammation of the kidneys, like other inflammatory diseases, results from cold, wet, intemperance, &c. (*See* BRIGHT'S DISEASE.)

KIEKIE, *kee'-kee.*—A tropical Asiatic and Polynesian shrub of the natural order *Pandanaceæ.* The fruit, a mass of fleshy berries, with a flavour somewhat resembling that of the strawberry, is the finest indigenous fruit of New Zealand.

KING-FISHER, *king'-fish-er.*—A genus of birds (*Alcedo*) of the order *Insessores,* family *Halcyonidæ.* The common king-fisher (*A. ispida*), well known in this country, is nearly the only European species, and is found also in Asia and Africa. It is a small bird, with very brilliant plumage, blue and green being the chief colours. It frequents the banks of streams, flies over the surface of the water, and having caught a small fish, kills it generally by beating it against the branch of a tree, and then swallows it, afterwards disgorging the indigestible parts. The tail of the bird is short and square, the legs and wings short, and the bill long and straight. The belted kingfisher (*A. Halcyon*) of North America is a much larger and less strong bird. In winter it migrates to the West Indies. It is generally supposed that the king-fisher was the halcyon of the ancients, which was believed to have the power of quelling storms. (*See* HALCYON DAYS.) It was formerly believed in this country, that if the stuffed skin of a king-fisher were suspended, the bill would always point to the direction from which the wind blew.

KING-WOOD, *king'-wood.*—An ornamental wood brought in small pieces from Brazil, and supposed to be the wood of a tree of the species *Triptolomia.*

KING'S EVIL. (*See* SCROFULA.)

KINIC, OR QUINIC ACID, *ki'-nik.*—A peculiar dibasic acid, occurring in chinchona bark, in combination with lime and the chinchona alkaloids.

KINKAJOU, *kin'-ka-joo.*—A quadruped (*Cercolptes candivolvulus*) of the family *Urridæ,* and resembling the racoons. It has a woolly fur of a yellowish colour, and is larger than an ordinary cat. It feeds on fruits, honey (from which it is, in some places, known as the honey-bear), and small animals. It is a native of the warm parts of America.

KINO, *ki'-no.*—An astringent substance exuded from the Pterocarpus and other tropical trees. (*See* PTEROCARPUS.)

KITE, *kite* (Sax., *cyta*).—One of the *Falconidæ,* readily distinguished even at a distance on the wing by its long forked tail. Its flight is characterized by gracefulness and ease, and in some districts it retains the old name of gled or glead, probably derived from the Saxon *glidan,* to glide. Sometimes the kite flies in circles, governing the curve with its rudder-like tail; it then stops and remains stationary for a time, with its tail expanded widely and its wings fully stretched out. The kite is distinguished from the falcons and hawks generally by pouncing on its prey upon the ground. It preys upon moles, frogs, leverets, rabbits, snakes, and particularly the young of various gallinaceous birds. The kite has become comparatively rare in England. It lays two and sometimes three eggs, of a soiled white colour, marked with a few reddish-brown spots over the larger end. The eggs are laid early in the season, and the birds defend their nest vigorously against all intruders. The kite is about twenty-four inches long, and the principal colours of the feathers are brown, dusky gray, and white. The females are rather larger than the males, but there is hardly any difference in their plumage. The bird is found in almost all parts of Europe, the north and centre of Asia, and the north of Africa.

KITTIWAKE, *kit'-ti-wake.*—A species (*Larus tridactyens*) of gull. It is very abundant in northern regions, and migrates to the south in winter, and is known in some parts of the British coasts as the Tarroch.

KLEPTOMANIA, *klep-to-mai'-ne-a* (Gr., *klepto*, I steal; and *mania*, madness).—A term applied to a species of insanity which manifests an irresistible propensity to steal. Innumerable instances might be adduced of persons of high character, and far beyond the reach of the temptation of poverty, who have apparently been unable to resist the impulse to steal, frequently taking articles of the slightest value, or, indeed, worthless, and with scarcely any effort at concealment.

KNEE, THE, *nee* (Sax., *cneow*; Ger., *knie*, *knæ*).—One of the most important joints of the human body, formed by three bones, the lower extremity of the femur or thigh-bone, the upper extremity of the tibia or larger bone of the leg, and the patella or knee-pan, which is situated in front of the joint, and serves to protect it from injury as well as to afford leverage to the muscles of the thigh in moving the leg. It is a small, flat, triangular bone, anteriorly a little convex and rough, for the insertion of muscles and ligaments; posteriorly smooth, covered with cartilage, and divided, by a middle longitudinal ridge, into two slightly concave surfaces, corresponding with the two convex eminences or condyles of the femur. The entire joint is bound together by a number of ligaments.

KNOWLTONIA, *nole-to'-ni-a.*—A genus of South African plants, of the natural order *Ranunculaceæ*. The leaves of one species, *K. vesicatonia*, possess great acridity and blistering power, and are used at the Cape of Good Hope as a substitute for cantharides.

KOALA, *ko'-a-la.*—A marsupial quadruped (*Phascolarctos cinereus*), nearly resembling the Phalangers. It frequently hangs from the branch of a tree, back downwards, like a sloth.

KOHL-RABI. (*See* BRASSICA.)

KOLA-NUTS. (*See* STERCULA.)

KOO-DOO, *koo'-doo.*—A large species of antelope (*A. strepsiceros*), native of South Africa. It is about eight feet long and four feet high, and the male has very long twisted horns; the colour is generally grayish brown, and white stripes along the back and on the sides.

KOOM-RAH, *koom'-rah.*—A species (*Equus hippagrus*), of the family *Equidæ*, found in the wooded mountainous regions of North Africa. It is about the size of an average pony. It has a long black mane, and the colour is a uniform reddish bay.

KOPP'S LAW, *kops.*—Two laws, the one relating to the proportional connection existing between the atomic volumes of certain liquids of the group $C\ H_2$; the other to a similar relation observed between the boiling-points of the same substances.

KOUMISS. (*See* KUMIS.)

KOUSSOO. (*See* BRAYERA.)

KUMQUAT. (*See* CITRUS.)

KUPFERNICKEL, *kup'-fer-nik-el* (Ger.)—A mineral containing 44 parts of arsenic to 56 of nickel. It occurs in Saxony and other parts of Europe in company with the ores of cobalt, silver, and copper, and forms one of the principal sources of nickel. It is also found sparingly in Cornwall.

KUTEERA. (*See* STERCULIA.)

L.

LABIATÆ, OR LAMIACEÆ, *lai-be-ai'-te, lai-me-ai'-se-e* (Lat., *labium*, a lip).—The Labiate family, a natural order of *Dicotyledones*, sub-class *Corolliflorœ*. Herbs or shrubby plants, usually with square stems. The order is a very large one, comprising 129 genera, or 2,350 species, mostly natives of temperate climates. The plants are altogether free from any deleterious qualities; they abound in volatile oil, and are commonly aromatic, carminative, and stimulant. Several are used in perfumery on account of their sweet odours; as the species of *Lavandula* (lavender) and *Pogostemon* (patchouli); while many are employed in the culinary art for flavouring; as thymes, sage, marjoram, mint, basil, savoury, &c.

LABIATIFLORÆ, *lab'-be-at-e-flore.*—The name given to a sub-order of *Compositæ*, characterized by the division of the hermaphrodite florets, or, at least, the unisexual ones, into two lips. No important plants belong to this sub-order. A few have aromatic and mucilaginous properties, and one, *Printzia aromatica*, a native of the Cape of Good Hope, is said to furnish a substitute for tea.

LABRADOR TEA. (*See* LEDUM.)

LABRADORITE, *lab'-ra-dor-ite.*—A silicate of alumina and lime, with certain admixtures of soda and iron. It receives its name from having been first found in Labrador, and is also known as Labrador stone. It is much valued as an ornamental stone, in consequence of the beautiful opalescent blue, or golden brown, lustre reflected from it when held in certain positions, owing to its translucency and nacreous structure.

LABRIDÆ, *lab'-ri-de.*—A family of osseous fishes, of which the wrasse and parrot-fish are species. They are generally oval or oblong, and more or less compressed, with a single dorsal fin, and the jaws covered by fleshy lips. The colours are brilliant. Some species are found on the British coasts, but they chiefly abound in tropical seas.

LABURNUM. (*See* CYTISUS.)

LABYRINTHODON, *lab-i-rin'-tho-don.*—A fossil sauriod batrachian of colossal size, portions of which have been found in the New Red Sandstone Measures. The head in some degree resembles that of the crocodile, but there are modifications which give it a batrachian character. The name ("labyrinth-tooth") was taken from the peculiar construction of the teeth. The fossil remains are generally accompanied by footprints, those of the fore foot being smaller than those of the hind foot. Owen has suggested a reconstruction of the animal, but the portions are too incomplete to permit of certainty as to the actual form.

LACE-BARK. (*See* LAGETTA.)

LACERTA, *la-ser'-ta* (Lat., *lacerta*, a lizard).—A constellation in the northern hemisphere, named by Helvetius. It is situated near Andromeda, of which it was formerly considered to be a part.

LACERTINIDÆ, *la-ser-tin'-e-de.* (*See* LIZARD.)

LACHRYMAL, *lak'-re-mal* (Lat., *lacryma*, a tear).—A term applied to various organs in the neighbourhood of the eye, and connected with the tears; as the lachrymal glands by which they are secreted, and the lachrymal duct by which they are conveyed away. (*See* EYE.)

LACHYSIS, *lak'-e-sis.*—A genus of serpents (*Crotalidæ*) of the rattlesnake family, but without the rattle, and having the head covered with scales. They are natives of the warm parts of America, six or seven feet in length, and very dangerous.

LACISTEMACEÆ, *lai-sis-te-mai'-se-e.*—In Botany, the *Lacistema* family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*. They are shrubby plants, natives of woody places in tropical America.

LACTEALS, *lak'-te-als* (Lat., *lac*, milk).—The name given to certain vessels of the human body, on account of their containing a milk-like fluid, the chyle. They serve to convey the chyle, or nutritious part of the food, from the intestines to the thoracic duct. They are very tender and transparent vessels, and are furnished with a large number of valves. They have their origin in the internal vellous coat of the small intestines, perforate the other coats, and then proceed through numberless converging branches between the layers of the mesentery, to the thoracic duct, the main branch of the absorbent system, which, at the part where the chief lacteal branches join it, is dilated into what is called the receptaculum chyli. In their passage through the mesentery, the lacteals traverse numerous mesenteric absorbent glands, where they communicate with veins, and the fluid contained in them is exposed to the influence of the blood, from which it acquires colouring matter and fibrin. (*See* DIGESTION.)

LACTONE, *lak'-tone.*—A volatile liquid, with a strong pungent odour, boiling at about 198° Fahr., found amongst the products of distillation of sugar-of-milk.

LACTUCA, *lak-tu'-ka* (Lat., *lac*, milk, from its milky juice). (*See* LETTUCE.)

LADANUM. (*See* CISTACEÆ.)

LADY-BIRD.—A well-known little insect belonging to the family *Coccinellidæ*, which comes under the class of *Coleopterous insecta*. The lady-bird is distinguished by a hemispherical and convex form of body, by the second joint of the tarsi being large and deeply bi-lobed, and by the colour of the spots on the elytra. Different species are found in various parts of the world, and in England it is common enough. The lady-bird is a very small insect, and its colour is generally red or yellow, with black spots, which vary both in size and number; or it is sometimes black, with white, red, and yellow spots. It creeps very slowly, but flies rapidly; and, when alarmed or caught, it ejects a yellow mucilaginous fluid of a strong disagreeable odour. This insect is very abundant in gardens troubled with aphides or plant-lice, which it is very useful in destroying; in hop-plantations, particularly, it is mostly seen. The young lady-birds are grubs of a small flattened appearance, which are produced from little yellow eggs, which the parent insect deposits among the aphides; so that, as soon as they are hatched, they are at once within reach of their prey, which they are easily able to destroy. In some parts of the country the name Lady-Cow is given. Some of the larger species are found all over Europe, and in some parts of Africa and Asia.

LADY'S MANTLE. (*See* ALCHEMILLA.)

LADY'S SLIPPER.—A genus of plants (*Cypripedium*) of the natural order *Orchidaceæ*. Many very beautiful species are natives of the colder parts of North America, and one, *C. calceolus*, found in some parts of the north of England, is one of the most attractive of British orchids.

LÆMODIPODA, *le-mo-dip'-o-da* (Gr., *laimos*, throat; *pous*, a foot).—The name of an order of *Crustaceans*, placed by Latreille between the *Amphidoda* and the *Isopoda*. All the species are marine. Among the sub-divisions are the *Filiformia*, which keep among the marine plants and sponges, walk like caterpillars, turn frequently and rapidly on themselves, or set up their bodies while their antennæ continue to vibrate. The subdivison *Cyamus* has three species, all of which live on the *cetacea*; and one of them, *Cyamus ceti*, is also found on the mackerel. It is called, by fishermen, the whale-louse.

LAGENARIA. (*See* GOURD.)

LAGERSTRÆMIA, *la-ger-stré-mi-a.*—A genus of plants of the natural order *Lythraceæ*, including the Jarvol of India and other fine forest trees; they have winged seeds.

LAGETTA, *lag-get'-ta* (*lagetto* is the name of the species in Jamaica).—A genus of the natural order *Thymelaceæ*. The species *L. lintearia* is the celebrated lace-bark tree. The bark, when macerated, may be separated into laminæ, the number of which depends upon the age of the specimen; these have a beautiful lace-like appearance, and possess great strength. It may be used for making ropes, and was at one time in great demand in the West Indies for making slave-whips. Sloane says that caps, ruffles, and complete dresses for ladies have been made from the lace-bark. Lagetta cloth has been imported into this country under the name of *guana*.

LAGOMYS, *la'-go-mis.*—A genus of rodent quadrupeds (family *Leposidæ*), in some respects resembling hares or rabbits, but with limbs of more equal length, longer claws, larger head, shorter ears, and no tail. The Alpine lagomys, also known as the pika of Siberia, is a little larger than a guinea-pig. All the species live in burrows; and are remarkable for the habit of storing up herbage in stacks of great size for winter food.

LAGOON, *lag-oon'* (Ital., *laguna*, Lat., *lacuna*, a hollow or pool).—A name applied to extensive creeks which run far inland, and are nearly encircled by the land, and also to lakes formed by the overflowing of seas and rivers, or infiltration from them. In some cases they are only separated from the sea by a bar of shingle. In the Adriatic there are many instances of them, as also along the coast of America and amongst the West-Indian islands.

LAKE, *laik* (Lat., *lacus*).—A portion of water surrounded by land. Some lakes are of immense size, as the groups of lakes in North America and Central Africa. Lakes may strictly be divided into four distinct classes:—Firstly, those which neither have an outlet nor receive any addition to their contents from running water; secondly, those which have an outlet and are fed by springs, receiving no superficial running water; thirdly, the class, which is by far the most numerous, that both receive and discharge streams of water; and lastly, those which receive tributaries, but have no visible outlet or communication with the sea. Of these latter, the Caspian Sea and Lake Aral are instances. It is, however, remarkable that most lakes of this description are found to be salt, Lake Tchad, in Central Africa, being an exception. There are many peculiar phenomena connected with lakes which are wholly unaccounted for. Among the rest, the faculty of disappearing, and reappearing again at intervals; as Lake Chirtunitz in Illyria, and also Lake Welter in Sweden, which experiences violent agitations during severe weather.

LAKE IRON-ORES.—Hydrated peroxide of iron is deposited in large quantities by certain lakes in Sweden and Norway. It is similar in composition to the bog iron ore found in other parts of Europe.

LAMB'S LETTUCE. (*See* VALERIANELLA.)

LAMBDOIDAL SUTURE, *lam-doy'-e-dal.*—The suture that unites the occipital to the two parietal bones of the skull, and is so named from its resemblance to the Greek letter *lambda.*

LAMELLÆ, *la-mel'-le* (Lat.).—In Conchology, those little plates of which the shells borne by crustaceous fishes are composed.

LAMELLIBRANCHIATA, *la-mel'-li-brank-i-a'-ta.*—A class of acephalous molluscs, with twelve shells and respiring by gills. Oysters, cockles, and mussels are well-known examples. Some species can swim or burrow in the sand, and some have small red spots on the edge of the mouth, which are probably eyes.

LAMELLICORNES, *la-mel'-li-kor-nees* (Lat., *lamella*, a plate; *cornu*, a horn).—A family of the *Coleoptera*, section *Pentamera*, including the stag-beetle and other large beetles. They have five joints to all the tarsi. The antennæ are inserted in a small hollow in front of the eyes, always short, and usually composed of 9 or 10 joints, the last of which are large and flat, and open out like a fan. The mandibles of several are membranous—a character observed in no other coleopterous insects. The family is numerous, and is noted for the brilliancy of the metallic colours which ornament those species which feed on living vegetables. The larva is soft, somewhat cylindrical in form, with a large vertical head. The food of these beetles consists of the dung of various animals, mould, and the roots of vegetables. Some of them live in decayed vegetable and animal substances, upon which they feed.

LAMIACEÆ. (*See* LABIATÆ.)

LAMINA, *lam'-e-na* (Lat., a layer).—A term applied to the different plates of minerals, or coats of bone, lying one above another. In Botany, the lamina means the broad and spreading part of the petal of a polypetalous carolla. In Anatomy, *laminæ* are the two plates or tables of the skull.

LAMINARIA, *lam-e-nah'-re-a* (Lat., *lamina*, a plate or layer).—A genus of *algæ*, or sea-weeds. *L. saccharina* is remarkable for containing upwards of 12 per cent. of the sugary matter called *mannite.* The young parts mixed with those of *L. digitata*, are eaten in Scotland, under the name of *tangle.* In China, *L. saccharina* is called *sea-tape*, and is a common article of food along the coast. *L. potatorum* is another edible species, used as a table vegetable in Australia.

LAMINATION, *lam-i-na'-shun.*—In Geology, the arrangement of rocks in their layers. (*See* GEOLOGY.)

LAMMERGEIER, *lam'-mer-gir* (Ger., *lamm*, lamb; *geier*, vulture).—A large bird of prey, known also as the Bearded Vulture. It forms a connecting link between eagles and vultures, approaching the latter more nearly. The expanse of wings is about 9 feet, and the bird is nearly 5 feet in length. The colour is a shining brownish-black on the upper part, with a white stripe along the shaft of each feather. The under part of the body and the neck are dull yellow, and the head is nearly white. It lives on animals newly killed, lambs, hares, young goats and chamois, and has been known to carry off children. It was formerly common on the Alps, but is rarely seen there now; and is found on the Pyrenees and in the mountains of Asia, Northern Africa, and South America.

LAMPREY, *lamp'-re* (Dan., *lampret*).—A genus of cartilaginous fishes (*Petromyzon*). The lamprey is distinguished by a cylindrical form, compressed towards the tail, and without any scales. It has seven branchial openings on each side, and another small opening connected with them on the upper surface of the head, situated nearly between the eyes; its maxillary ring, or mouth, is supplied with strong teeth, and in the inner disc there are smaller, rasp-like tubercles; its tongue is so formed that, by a movement of the mouth, it acts like a piston, and enables the lamprey to attach itself to any foreign body by means of suction. It is usually about two feet in length and of a yellowish colour, mottled with brown irregular streaks. The two dorsal fins are distinctly separated, the second one joining with the tail-fin, as well as with a small strip which represents the anal fin. To save themselves from the constant muscular exertion which is necessary to prevent them from being carried along with the current of the water, they attach themselves by the mouth to stones or rocks, and are in consequence called petromyzon, or stone sucker. The lamprey generally quits the sea in the spring for the purpose of spawning, and then returns back to its element after an absence of a few months. It is a fish in high repute as an article of food, and it is, consequently, much sought after for the table. Those from the river Severn are held in the highest esteem. A smaller species, the river lamprey (*P. fluviatilis*), known also as the Lampen, is found in some English rivers.

LAMP-SHELL.—A genus (*Terebratula*) of *Brachiopoda;* the shell is very delicate. (*See* BRACHIOPODA.) Many fossil species are known.

LAMPYRIDÆ, *lam-pi'-re-de* (*Lampyris*, Linn.).—A family of coleopterous insects, of the section *Malacodermi*. The *Lampyridæ* have five joints to all the tarsi; flexible elytra, with the body usually elongated and somewhat depressed. The head is more or less concealed by the thorax, the mandibles generally small and terminated in a sharp point; the penultimate joint of the tarsi is always bi-lobed, the claws simple, and the antennæ closely approximated at the base. The family of the *Lampyridæ* contains several genera, one of which is *Lampyris*, the glow-worm. (*See* GLOW-WORM.)

LANCELET, *lance'-let.*—A genus (*Amphioxus*) of Dermopterous fishes. They are the lowest form of vertebrate animals, appearing to connect cartilaginous fishes with molluscs and annelids. Only a few species are known, all small, about two inches long. They bury themselves in banks of sand. They are silvery white and semi-transparent. The skeleton is merely rudimentary, and there is no appearance of a skull or enlargement of the spinal cord into a brain.

LANCEOLATE, *lan'-se-o-lait* (Lat., *lancea*, a lance).—A term used in Botany to signify a leaf, or other part of a plant which is of a narrow, oblong form, gradually tapering towards each extremity. In a similar sense, the same term is used in conchology and entomology.

LANCEWOOD. (*See* DUGUETIA.)

LANDRAIL, a migratory bird, visiting the British Isles in the summer, and returning during the winter to the shores of the Mediterranean.

LANDSLIP, *land'-slip.*—A portion of land which has been separated from the main body, or which has slid down, usually from the side of a mountain or hill, in consequence of disturbance by an earthquake, or from being undermined by long-continued rains, or from some other cause. Landslips of considerable extent sometimes occur, and are occasionally attended with great injury. In Switzerland and other mountainous countries they are not infrequent, and are often very disastrous and terribly fatal.

LANGSAT. (*See* LANSIUM.)

LANGSDOFFIA. (*See* BALANOPHORACEÆ.)

LANIADÆ, *lan-i-a'-de.*—A family of birds, the largest and most rapacious of the *Dentirostres*. The Shrikes, or *Butcher-birds* (which *see*), are the types of the family.

LANNER, *lan'-ner.*—A species of falcon (*Falco lannarius*). The male bird, being smaller than the female, is, in the language of falconry, known as a lanneret.

LANSIUM, *lan'-shum.*—A genus of plants, of the natural order *Meliaceæ*, inhabiting the East Indian Archipelago. They yield fruits which are much esteemed, and known under the names of the *langsat* or *lanseh*, and the *ayer-ayer*.

LANTANIUM, OR LANTHANIUM, *lan-tai'-ne-um* (Gr., *lanthanein*, to conceal).—An extremely rare metal, found in small quantities in the minerals *cerite*, *yttrocerite*, and one or two more, in company with cerium and didynium. It forms a gray, infusible, non-volatile powder, that becomes lustrous when burnished. It forms only one oxide which is a white powder, soluble in acids, and in the salts of ammonia, from which it expels the alkali. Its salts have a sweet, astrigent taste, and are unimportant.

LANTERN FLY.—A remarkable genus of bright-coloured, homopterous insects (*Fulgoria*) allied to the *Cicadidæ*, but destitute of the power of producing the sound characteristic of the crickets and grasshoppers. The head is generally prolonged, and of very singular formation. They are natives of tropical regions. It has often been asserted that the projection of the head of one large species, *F. laternaria*, found in Guiana, is luminous, whence the popular name; but the fact has not been satisfactorily established.

LAPIS LAZULI, *lai'-pis laz'-u-le* (Lat., azure-stone).—A well-known mineral of an ultramarine or azure-blue colour, formerly much used for the production of the pigment known as ultramarine. It varies considerably in composition, according to the locality in which it is found. It occurs in primitive limestone and granite in Eastern Asia and South America. Some of the finest specimens are brought from Thibet. It may be described chemically as a silicate of alumina and lime, coloured with variable amounts of iron and sulphur. Since the introduction of artificial ultramarine, it is principally employed for ornamental purposes. (*See* ULTRAMARINE.)

LAPWING, OR PEEWIT, *lap'-wing.*—One of the best-known of the British birds, belongs to the family *Charadriadæ*, which includes the snipe and plover tribe. The generic characters of this bird (*Vanellus cristatus*) are—straight, slightly-compressed bill, shorter than the head; points of both mandibles hard and horny; legs slender, with lower part of tibiæ naked; four-toed feet, three before, one behind; large wings, tuberculated or spurred in front of the carpel joint; first three quill feathers in front shorter than the fifth. The name which this bird bears have been suggested, the first by the slow flapping of its wings during flight, and the second by its often repeated note, with which the sound "peewit" is closely similar. An inhabitant of heaths, commons, and the marshy ground near rivers or lakes, these birds resort in numerous flocks to certain districts in Norfolk, Lincolnshire, Cambridgeshire, and Essex, where the trade of collecting them for the table continues for about two months. The eggs, sold as plovers' eggs, are esteemed a great delicacy.

LARCH, *lartsh.*—A genus of trees of the natural order *Coniferæ*, differing in some peculiarities of the core and leaves from the fir with which it is sometimes classed. The larch is of elegant and graceful appearance, is much grown in England for the sake of the timber that is obtained from it. There are many points in which the wood of the larch is superior to any other for certain purposes. For timbers that are exposed to the action of water, and for posts, the ends of which are driven into the ground or into the banks of rivers, the larch is more durable than either oak or elm; and for this reason it is much used by civil engineers in the construction of railways, canals, wooden bridges, &c. It will bear a considerable degree of heat without shrinking, warping, or cracking. It is tolerably free from knots, and the grain is close and capable of receiving a high degree of polish. It is not so easy to saw and plane as deal, chestnut, or oak; and, consequently, it is not used to any great extent in house joining. It is as good as oak for planking the sides of small vessels; and, on account of the manner in which it will bear the changes of temperature and the variations of the weather, it is particularly useful for railway-sleepers, the shafts of mill-wheels, and other purposes where it is exposed to damp. Pipes for the conveyance of water are made from the larch in France and Switzerland, and larch poles are used in the continental vineyards for the support of the vines. The wood yields an excellent charcoal, and a superior kind of turpentine, known as Venice turpentine, is procured by making incisions in the tree, and collecting the sap that exudes from it in vessels placed to receive it. In France this exudation is known as *Briançon Manna*. Squared logs of larch are used for building houses in Switzerland; and in the Rhenish provinces of Prussia, France, and Germany, wine-casks are made from it. The bark is used in tanning leather, but it is not so good as the bark of the oak. The planting of the larch has been much encouraged of late years in Great Britain. It will grow on any land, however poor or barren it may be; and land which is utterly worthless for other purposes may thus be made valuable and remunerative. There are several American and Himalayan varieties.

LARDIZABALACEÆ, *lar-de-zab-a-lai'-se-e* (after Lardizabal, a Spanish naturalist).—The *Lardizabala* family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*, twining shrubs. Two genera inhabit the cooler parts of South America; one is tropical, and the remainder are found in the temperate parts of China. The order has furnished our greenhouses with some pretty evergreen climbers.

LARIDÆ, *la'-ri-de.*—A family of birds of the order *Palmipedes*, or *Natatores*, characterized by a great length of wing. They are sea birds, and capable of rapid and graceful flight for very long distances. Sometimes they ascend rivers for many miles. Gulls, terns, petrels, and albatrosses belong to this family.

LARK.—A genus of small birds (*Alauda*) of the order *Insessores*. They have long wings and great power of flight, and most of the species are birds of passage. They are found in nearly all parts of the world. The common lark, or sky lark (*Alauda arvensis*), is well known in all parts of Britain. Its song, while floating in the air, rivals that of the nightingale, in the estimation of poets. Shelly and Allan Cunningham especially have been inspired by the lark. As a cage bird, it loses little of the beauty of its song, except that derived from the various distances from which it reaches the ear, as it soars into the sky, or rapidly descends. The colour of the upper part is brown; the belly is of a brighter colour, and the breast is nearly white, with brown spots. The nest is generally made in an open field, under shelter of a thick tuft of grass or a clod of earth. The eggs, four or five in number, are mottled, and there are generally two broods in a season. The crested lark (*A. cristata*), is seldom seen in Britain, though very common in France and some other parts of Europe. The wood lark (*A. arborea*), is a smaller species, which usually sings perched on a branch of a tree, and fully shares the musical gifts of the family. There is only one American species, the shore lark (*A. alpestris*), found also in the northern parts of Europe and Asia. The plumage is brown, varied by black, white, and yellow, and the head has two erect tufts of feathers.

LARKSPUR, *lark'-spur.*—A genus of plants (*Delphinium*) of the natural order *Ranunculaceæ;* annual and perennial herbaceous plants. They are natives of the temperate and cold regions of northern countries. Some of the species are favourite garden flowers.

LARVA, *lar'-va* (Lat., a mask).—A term applied to an insect in its first state after leaving the egg, and previous to its assuming the chrysalis or pupa form. Larvæ are generally known by the names of grubs, maggots, and caterpillars. Many marine animals pass through a stage of existence which may be described as a larva state, in which they have little resemblance to the full-developed creature. (*See* INSECTA, INSECT TRANSFORMATION.)

LARYNGITIS, *lar-in-ji'-tis* (Lat.).—Inflammation of the larynx, more particularly of the mucous membrane that covers the laryngeal cartilages, including the epiglottis. This disease is characterized by a high degree of fever; the pulse is frequent and hard, and the patient manifests a considerable degree of restlessness and anxiety; he likewise complains of a sore throat; and among the earliest symptoms that bespeak danger is difficulty of deglutition, for which no adequate cause is visible in the fauces; and to this is generally added difficulty of breathing. The act of inspiration is protracted and wheezing, and the patient speaks either hoarsely, or, what is more common, all power of audible voice in the larynx is lost, and he speaks only by means of his lips and tongue in a whisper. As the disorder advances, the patient's general distress increases. His countenance, from being flushed, becomes pale or livid; his look anxious and ghastly; he struggles for breath, and if he does not obtain timely relief, dies strangled. Its course is generally rapid, terminating fatally before the fifth day, and even, in some cases, within twelve hours. Active remedies, therefore, require to be promptly applied. Blood-letting, both generally and locally, and blistering, are to be immediately resorted to during the periods of the fever; but if the powers are beginning to sink, blood-letting will be of little use. In such cases, however, tracheotomy may be resorted to with advantage, and the operation of breathing carried on by means of an artificial opening till the part of the larynx recover. (*See* TRACHEOTOMY.)

LARYNX, *lar'-inks* (Lat.)—The organ of the voice situated at the upper and fore part of the neck, where it forms a considerable projection. It extends from the base of the tongue to the trachea; is narrow and cylindrical below, but broad above, where it presents the form of a triangular box, being flattened behind and at the sides, whilst in front it is bounded by a prominent vertical ridge. It is composed of cartilages connected together by ligaments, moved by numerous muscles, lined by mucous membrane, and supplied with vessels and nerves. The cartilages of the larynx are nine in number, three single and three in pairs, one, the thyroid cartilage, forming that prominence which is felt in front of the throat, called *pomum Adami* (Adam's apple). The epiglottis is a thin lamina of fibro-cartilage, shaped like a leaf, and placed behind the tongue, in front of the superior opening of the larynx. During respiration, its direction is vertically upwards, its free extremity curving forwards towards the base of the tongue; but when the larynx is drawn up beneath the base of the tongue during deglutition, it is carried downwards and backwards, so as to completely close the opening of the larynx. The upper opening of the larynx is termed the glottis. The mucous membrane of the larynx is continuous with that lining the mouth and pharynx, and is prolonged through the trachea and bronchi into the lungs. The vocal ligaments are two narrow bands of dense fibrous and highly elastic tissue, stretched between the anterior angle of the thyroid and the anterior surfaces of the arytenoid cartilages.

LASTREA, *las'-tre-a.*—A genus of ferns containing several species, belonging to the tribe *Aspidiæ;* such as the *Lastrea filixmas*, or male fern. This fern has been used in this country and other parts of Europe in medicine; the rhizome, when powdered, is considered an excellent vermifuge, especially in cases of tapeworm. It is also used for tanning.

LATENT HEAT. (*See* HEAT.)

LATERITE, *lat'-e-rite.*—A mineral substance produced by the partial decomposition of gneiss, and is of a bright red colour when a considerable quantity of iron is present; but when felspar preponderates, it is of a white colour, and, if hornblende, then yellow.

Lateritious, *lat-er-ish'-us*, applied to the red sediment deposited from the urine in some stages of fever.

LATES, *la'-tees.*—A fish (*Lates Niloticus*) of the perch family, found in the Nile, and of very fine flavour. It is sometimes as long as a large salmon. Another species (*L. nobilis*) is caught in the Ganges, and is considered a delicacy by the English residents, who know it as "cock-up." The proper name is vacti.

LATHYRUS, *la-ti'-rus.*—A genus of plants of the natural order *Leguminosæ*, sub-order *Papilionaceæ*. They are annual and perennial and herbaceous, natives of temperate regions in the northern hemisphere. There are many species, some having large and beautiful flowers. The Everlasting Pea, the Sweet Pea, and the Meadow Vetchling, belong to this genus. The Chickling Vetch, or Lental of Spain (*L. saturis*), is cultivated in many parts of Europe and in India for its seeds, the flower of which is mixed with other flowers. Taken alone, the flower is dangerous on account of its narcotic qualities, and has been known to produce paralysis. The tubers of one variety are eaten in Germany.

LATISSIMUS DORSI, *lat-is'-se-mus dor'-si* (Lat., *latissimus*, broadest, and *dorsum*, the back).—The name of a broad, flat muscle of the back, which serves to move the humerus downward and backward, and to turn it upon its axis.

LATITUDE AND LONGITUDE, *lat'-e-tude* (Lat., *latitudo*, breadth; *longitudo*, length).—Latitude and longitude are the means by which the exact position of any place on the earth's surface, or any star in the field of the heavens, may be determined and described; but latitude and longitude in geography are not identical with latitude and longitude in astronomy, and the terms require a separate definition, according to their acceptation in each science. In Geography, the position of any place on the earth's surface is indicated by the intersection of two imaginary circles at right angles to each other, one of which is a great circle passing through the place itself and the poles perpendicularly to the plane of the equator; and the other, the equator itself, if the place happen to be situated on that line, or a circle, the plane of which passes through the place in question in a direction parallel to the plane of the equator. Of these circles, the former shows the degree of longitude on which the place is situated, and the latter the degree or parallel of latitude. (*See* DEGREE.) In Astronomy, the latitude of any star is its angular distance from the ecliptic, measured on a great circle, the plane of which passes through the star and the poles of the heavens; or it may be defined as the arc of this great circle that is intercepted between the position of the star and the ecliptic, while its longitude is the angle made by the inclination of the planes of two great circles which intersect in the axis of the heavens, one of which passes through the star and the poles of the heavens, and the other through the poles of the heavens and the intersection of the equator and the ecliptic at the vernal equinox; or, in other words, the arc of the ecliptic intercepted between the planes that pass through the star and the first point of Aries, and the poles of the heavens, at right angles to the plane of the ecliptic. In astronomy, therefore, the longitude of heavenly bodies is measured along the ecliptic instead of along the equator, as in geography; and celestial longitude is reckoned all round the ecliptic eastward in one direction, from 0°, or the first point of Aries, to 360°. It should be said that, in astronomical writings and calculations, the longitude of places on the earth's surface is reckoned and noted in the same manner, and not E. and W. of Greenwich, as in geography. The positions of the heavenly bodies are not now determined by latitude and longitude, but by their right ascension and declination. (*See* ASCENSION, RIGHT; DECLINATION.) The methods of determining the latitude of a place are various. The following is generally adopted at fixed observatories, especially in Europe, where the pole is situated high in the heavens, and circumpolar stars are far above the horizon, and it is effected by means of accurate transit, mural, or altitude and azimuth circles. The precise situation of the pole is found by observing the altitudes of stars which are close to the pole, and describe small circles round it, at their culminating points above the pole and below it. When these observations have been duly corrected, the position of the pole, which lies midway between the culminations of the star above and below it, may be determined, and its altitude, and consequently the latitude of the place, may be found. In determining latitudes at or near the equator, the altitudes of the sun must be observed, both before and after either the summer or winter solstice, from which the altitude of the point midway between them, which lies in the equator, may be deduced, and the latitude determined. There are other methods by which the latitude of a place is determined differentially, as it is termed, in which the use of data of the polar distances of stars ascertained at other observatories is involved, and the polar distance of the zenith, which corresponds to the co-latitude of the place, is ascertained from observations of the meridian zenith distances of stars which pass near the zenith, and of which the polar distances are known. This is effected by means of the zenith sector, and there are other methods of obtaining the latitude differentially, in which the transit instrument, the repeating circle, and Troughton's reflecting circle, are used; but it is beyond the compass of the present work to describe the *modus operandi* in each case *seriatim*. At sea the latitude is sometimes obtained by taking the altitude of the sun above the visible horizon when on the meridian, by means of a sextant, and sometimes recourse is had to observations of the moon, the planets, and some of the more brilliant stars, when they are at the meridian. With regard to the determination of the longitude of any place on the earth's surface, as it may be known as soon as the difference between Greenwich time and the time at the place in question has been ascertained, it is manifest that these two points must be known before its longitude can be determined. The time at Greenwich may be known by reference to the chronometers, which are always carried on board ship for this purpose. (*See* CHRONOMETERS.) But Greenwich time may also be ascertained astronomically from the observation of such phenomena as the eclipses of Jupiter's satellites (*see* JUPITER), solar eclipses, and the occultations of fixed stars by the moon; and tables of these phenomena, including the occultations by the moon of all fixed stars to the sixth degree of magnitude, are noted in the "Nautical Almanac," according to the time at which they would take place at Grenwich. Another method of finding the longitude of a place consists in taking observations of the transit of the moon and certain stars, which happen to be near her parallel of declination, across the meridian with a transit instrument. The stars which should be observed with the moon, to afford the means of correcting the moon's transit, are noted in the "Nautical Almanac," as well as the variations in the right ascension of the moon for an hour of longtitude. The right ascension of the moon having been ascertained, which will be less than its right ascension at Greenwich if the place be east of Greenwich, and greater if west, the difference between the right ascension at each place must be obtained, and the result divided by the variation in an hour of longitude, which gives the longitude of the place in hours and decimal parts of an hour. At sea, where a transit instrument cannot be used, the longitude is found by taking lunar observations—that is to say, by observing the distance of the moon from the sun, or any of the planets or fixed stars, by means of a sextant. These distances are calculated and registered in the "Nautical Almanac" for every successive interval of three hours, according to Greenwich time, by which the observer is enabled to determine the Greenwich time that corresponds to the time of observation at the place. When a planet or star is the object observed, the hour angle must be added to its right ascension when it is to the west of the meridian, and substracted from it when it is to the east. This gives the sidereal time, which can be readily reduced to mean solar time. Greenwich time, and the time at the place of which the longitude is required, having been ascertained, the difference between the two, when reduced to degrees, minutes, and seconds, will give the longitude of the place in question, and the place will be known to be east or west of Greenwich, according as the time there is later or earlier than Greenwich time. The details of the various operations and calculations employed in practice may be gathered from any work on the science of navigation, as well as from works on astronomy and geodesy.

LATTICE LEAF, *lat'-tis.*—A plant (*Ouvirandrano fenestralis*) known also as Lace Leaf, Water Yam, and by the native name Ouvirandrano. It grows in running streams in Madagascar. The root stock is nearly an inch in diameter, and seven or eight inches long, white in the interior, farinaceous, and used for food. The blade of the leaf resembles lattice-work of a regular pattern; hence the name. The plant is very beautiful, and thrives in hot-houses and aquariums in this country.

LATUS RECTUM. (*See* ELLIPSE, HYPERBOLA, CONIC SECTIONS.)

LAUGHING-GAS.—Protoxide of nitrogen; so called from its effects upon the human system. (*See* NITROGEN, PROTOXIDE OF.)

LAUNCE, *lance.*—A genus of fishes (*Ammodytes*) of the eel tribe, with very elongated bodies and dorsal fins extending the whole length of the back, and forked tail fins. One well-known species, the sand-eel, found on the British coasts, is about a foot long. There are much smaller species.

LAURACEÆ, *law-rai'-se-e* (Lat., *laurus*, a laurel).—The Laurel family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*. The order comprises 54 genera and 450 species. They are chiefly natives of tropical regions; but a few occur in North America, and one (*Laurus nobilis*) in Europe. The possession of aromatic properties, which are due to the presence of volatile oils, characterizes nearly all the plants of this order. Several have edible fruits, and many yield valuable timber. Among the useful products of this order are *cinnamon*, *cassia*, *camphor*, *sassafras*, and *bibiru bark*. (*See* LAURUS.)

LAUREL. (*See* LAURUS.)

LAURUS, *law'-rus.*—The typical genus of the natural order *Lauraceæ*. The species *L. nobilis* is the sweet-bay, or laurel, and probably the *Ezrach*, or green bay-tree of the Bible. It is the classic shrub that furnished the heroes of antiquity with their laurel crowns. The fruit is officinal, under the name of *bay* or *laurel berries*, and reputed to be aromatic, stimulant, and narcotic. By distillation with water, these berries yield the *volatile oil of sweet bay*. A substance called *expressed oil of bays*, or *laurel fat*, is also obtained from the fruits, both fresh and dry, by pressing them after they have been boiled in water. Laurel-leaves have somewhat similar properties to the fruit. They are used in cookery for flavouring. They must not be confounded with the leaves of the poisonous cherry-laurel.

LAVA, *la'-va* (Ital.)—A general term applied to the mineral substances produced by active volcanoes. When an eruption occurs, the lava is expelled in a semi-fluid mass, about the consistence of butter; it soon cools, however, on the exterior surface, while the internal mass remains liquid for a considerable length of time. Lava consists principally of pyrocene, or augite; but various minerals enter into its composition.

LAVANDULA, *lav-an'-du-la* (Lat.)—The Lavender, a genus of the natural order *Labiatæ*. The flowering heads of *L. vera*, the well-known lavender, yield by distillation with water *English oil of lavender*, which is largely employed in perfumery; and also in medicine, as a stimulant, stomachic, and carminative. The flowering heads of *L. spica* or *latifolia*, French lavender, yield *oil of spike*, or *foreign oil of lavender*, which has a much less agreeable odour than the English oil, and is not employed medicinally. It is used principally by painters on porcelain and varnish-makers, and to adulterate the English oil. *L. Stæchas* also yields by distillation an essential oil, which is commonly distinguished as *true oil of spike*.

LAVENDER. (*See* LAVANDULA.)

LAVER. (*See* PORPHYRA.)

LAWSONIA, *law-so'-ne-a*.—A genus of the natural order *Lythraceæ*. *L. inermis* is the plant from which the *henna* or *alkanna* of Egypt, &c., is derived. It is used by the women of the East to dye the nails, palms of the hands, and soles of the feet an orange-brown colour. It is likewise employed for dyeing skins and morocco leather.

LAZULITE, *laz'-u-lite*, a light-blue mineral, resembling *lapis lazuli* in colour only. It is a hydrous combination of the phosphates of alumina, magnesia, lime, and iron. It is also known as *azurite* and *prismatic azure spar*.

LEAD, *led* (Sax., *lead*).—One of the most important of the metals, both itself and its compounds being applied to many useful purposes. It occurs in nature in combination with a large number of substances; but its most valuable ore is galena, or sulphide of lead, found in large quantities in various parts of the world. In this country it is found mixed with quartz blende, iron pyrites, heavy spar, and fluor spar, in veins running through the primitive rocks of Cornwall and Cumberland. It generally contains a small proportion of sulphide of silver, often in sufficient quantity to allow of its being separated profitably. Lead is a bluish-white metal, so soft that it may be marked with the nail. It may be beaten into pretty thin sheets, as well as drawn into wire; but its malleability and tenacity are both low. It fuses at 630°, and may be obtained in cubic or octahedral crystals as it cools. It does not cast well, owing to its contracting at the moment of solidifying.

Chemistry of Lead.—The symbol is Pb (plumbum), equiv. 103·57, spec. grav. 11·44. Chemically speaking, lead occupies a position between silver and mercury, being closely allied to these two metals in many of its re-actions. The salts of lead are mostly colourless. They are all highly poisonous, the best antidote being sulphate of soda, or magnesia, which forms a comparatively inert and insoluble sulphate. In the more usual forms of lead-poisoning, when, for instance, the metal becomes introduced into water from the incautious use of lead pipes, these antidotes are ineffectual. The best tests for the presence of lead are the formation of an insoluble white precipitate, when sulphuric acid, or sulphates, are added to the suspected solution. This test should be confirmed by forming a black sulphide with sulphuretted hydrogen, a yellow chromate with chromate of potash, and a yellow iodide with iodide of potassium. Lead has a comparatively weak affinity for oxygen; it consequently remains almost unoxidized even in damp air. It is easily precipitated in a metallic form from its solutions by other metals. Under the combined action of air and pure water, lead is liable to corrosion; great care should therefore be exercised in using lead pipes in districts supplied with pure water.

LEAD POISONING.—Several very dangerous, and unless properly attended to, not unfrequently fatal diseases, are caused by the absorption of lead into the system. To such diseases, painters and others who are constantly handling white lead are liable, and the use of water which has become charged with lead-salt is productive of very serious consequences. The most frequent of these diseases are *Lead Colic*, distinguished from other kinds of colic by a blue line on the gums; *Lead Rheumatism*, also marked by a blue line on the gums. *Lead Palsy*, most frequently affecting the muscles of the thumb and the extensors of the wrist, giving rise to what is known as wrist-drop; and more rarely, *Disease of the Brain*. Among the remedies employed are sulphuretted baths, and the administration of draughts of water acidulated with sulphuric acid or a solution of sulphide of magnesium, and afterwards of iodide of potassium. These remedies eliminate the lead from the system. For lead palsy, after the lead has been driven out, electricity and minute doses of strychnine are valuable remedies.

LEAF, *lefe* (Sax., *leafe*.)—The organ which, in the higher orders of plants, is specially concerned in the elaboration of the various vegetable secretions. It invariably grows from the stem, and is generally a flat, expanded body, formed of vegetable tissue, strengthened by a woody framework or skeleton. The parts of the stem from which the leaves spring are called *nodes*; and the spaces between such parts, *internodes*. The leaf usually grows horizontally; so that one surface looks to the sky and the other to the earth; but in some plants the leaves are placed vertically, with their edges directed to those points. The latter mode of growth is rare, and the terms *upper* and *lower* are generally applied to the two surfaces. The part of the leaf next the stem is called the *base*, the opposite extremity the *apex*, and the lines connecting these two points the *margins* or *edges*. The angle formed by the upper surface of the leaf with the stem is styled the *axil*, and everything which springs from this angle is said to be axillary. The leaf is sometimes articulated with the stem, and when it falls off a scar remains; at other times it is continuous with it, and then decays gradually without dropping off. When leaves fall off annually, they are said to be deciduous; when they remain for two or more years, they are *persistent* or *evergreen*. A leaf usually consists of two distinct parts—a flat, expanded portion called the *blade*, *lamina*, or *limb*, and a narrower portion which joins it to the stem, and which is termed the *petiole* or *leaf-stalk*. The apex of the blade is the oldest part of such a leaf, and the base of the stalk the youngest. When a leaf has no distinct stalk, but consists of the flat portion only, it is said to be *sessile*. The occurrence of two little organs at the base of the leaf-stalk is frequent; and as these usually resemble the expanded part of the leaf, they have been termed *stipules*, or little blades. But though commonly of a leafy character, stipules sometimes take such curious forms that they can only be identified by their position at the base of the petiole, or the blade if the leaf be sessile. In the rose, the stipules appear as little membranous parts adhering to the base of the leaf-stalk. In the common mallow, and in the geranium, they take the form of little leaves, and proceed, not from the leaf-stalk, but from the stem of the plant, at either side of the base of the leaf-stalk. In the wild heartsease they are extremely large, and are divided into several segments. In the robinia they occur as sharp prickles, and in the smilax as delicate tendrils. Stipules, when present, whatever their form, are to be regarded as portions of the leaf, and not as distinct organs. They appear at a somewhat late period of the development of the leaf, but their growth is exceedingly rapid, owing to their close proximity to the stem. Leaves generally consist of vascular tissue, in the form of *veins*, *ribs*, or *nerves*, and of soft cellular tissue, or *parenchyma*, filling up the interstices between the veins. The term *venation* has been applied to the distribution of the veins. In most leaves this can be easily traced; but in the case of some succulent plants the veins are obscure, and the leaves are said to be *hidden-veined*. Again, in the lower tribes of plants, as the mosses and sea-weeds, the leaves are not strengthened by vascular tissue, and from being destitute of true veins, they have been termed *veinless*. In an ordinary leaf there may be observed a central vein larger than the rest, which is called the *midrib*; this gives off veins laterally, which either end in curvatures within the margin, as in the leaf of the lilac, or proceed directly to the edges, as in the oak-leaf. The veins give origin to smaller ramifications, which are distinguished by the term *veinlets*. Some leaves, as those of the common sycamore, have, in place of a midrib, three or more large veins, which proceed from the base to different parts of the margin, such veins being simply termed ribs. Leaves in which the veins form a sort of network are said to have a *reticulated* or *netted venation*: the leaves of all our forest trees and most of our herbs are examples. Those leaves in which the main veins are more or less parallel, and simply connected by unbranched veinlets, are said to have a *parallel venation*: the grasses, lilies, palms, and most monocotyledonous plants furnish examples.

Varieties of Leaf.—Leaves have been divided into *simple* and *compound*. A leaf is simple if it has only one blade, however much this may be divided: the pear, the oak, the lilac, and the cabbage have simple leaves. A leaf is compound when the blade is separated into two or more distinct portions, each of which bears the same relation to the petiole as the petiole itself bears to the stem from which it arises. The separate portions of a compound leaf are called *leaflets*; and these may either be sessile or furnished with stalks, called *petiolules* or *partial petioles*; the main axis which supports them being termed the *rachis* or *common petiole*. The leaflets of a compound leaf may be at once distinguished from the separate leaves of a branch by their being all situated on the same plane; moreover, the entire leaf, when it dies, commonly falls off the stem in one piece, and not leaflet by leaflet. The leaves of the rose, clover, elder, and horse-chesnut are familiar examples. The margins of leaves are sometimes smooth and undivided; but more frequently indented or scalloped. A leaf is said to be *entire* when its margins are smooth, as in the garden nasturtium and the whole orchis tribe. Of the *indented* or *toothed* leaves, botanists name several varieties, the following being the principal:—*Serrate*.—Having teeth, like those of a saw, directed towards the apex; as in the common nettle. *Biserrate*.—With teeth which are themselves serrate; as in the nettle-leaved bell-flower. *Serrulate*.—Minutely serrate; that is, having very small teeth. *Dentate*.—With large, sharp teeth, not pointing in any particular direction. *Crenate*.—Having rounded projections in place of angular teeth; as in the ground-ivy and the horse-radish. *Bicrenate*.—With rounded projections which are themselves scalloped. *Crenulated*.—Minutely scalloped. A simple leaf is sometimes more divided than in the above instances, and the segments produced receive different names, according to their nature. If the incisions reach about midway between the margin and midrib, or petiole, the leaf is said to be *cleft*, and its divisions are called *lobes*; if they extend almost as far as the midrib or base, the leaf is *partite*, and the divisions are then termed *partitions*; and if they quite reach the midrib or base, *segments* are formed, and the leaf is said to be *dissected*. These segments differ from the leaflets of a compound leaf in never being articulated, and also in each being united to the midrib or petiole by a broad base. In describing incised leaves, such terms as *bifid*, or two-cleft; *trifid*, three-cleft; *multifid*, many-cleft; *tripartite*, *trisected*, and so on are generally used. Special terms are applied to the various modifications of the compound leaf. It is *pinnate* when the leaflets (or *pinnæ*, as they are sometimes called) are arranged along the rachis in pairs; it is *abruptly pinnate* when it ends with a pair of leaflets, and *unequally pinnate* when there is a single terminal leaflet. Sometimes the leaflets of a pinnate leaf are themselves so divided as to appear pinnate; such a leaf is *bipinnate*. The secondary leaflets (or *pinnules*, as they are termed) may in like manner become pinnate, and so produce a *tripinnate* leaf. When the division extends beyond this point, a *decompound* leaf is the result: examples are afforded by many umbelliferous plants. In many compound leaves the leaflets proceed from the same point instead of being arranged along each side of a common stalk. If such a leaf consists of three leaflets, it is *ternate*, as in the strawberry; *quadrinate* if there are four, as in herb Paris; *quinate* if there are five; *septernate* if there are seven, as in the horse-chestnut; and *multifoliate* if there are more than seven, as in lupin. These leaves, like those which are pinnate, may be again divided and subdivided; thus the common petiole may divide at its apex into three partial ones, each of which bears three leaflets—such an arrangement producing a *biternate* leaf.

LEAF-CUTTER BEE.—A name given to certain species of solitary bees (*see* BEE), on account of their habit of lining their nests with portions of leaves or petals of flowers, cut from the plant by the sharp mandibles of the insect. The common British species (*Megachile centrincularis*, makes very curious nests of the leaves of roses, fitted together so as to make a thimble-shaped cell.

LEAF INSECT.—A remarkable genus (*Phyllium*) of the *Phasmidæ* family, known also as the walking-leaf, or Leaf Butterfly. The resemblance of the wings to a leaf is very striking, and the joints of the legs are also expanded in a leaf-like manner. They are natives of tropical climates.

LEATHERWOOD.—A deciduous shrub (*Dirca palustris*), of the natural order *Thymeleaceæ*, a native of North America. The tough bark is used for ropes and baskets. The yellow flowers appear before the leaves.

LECANORA, *lek-a-no'-ra* (from Gr., *lekane*, a basin, in allusion to the form of the shields).—A genus of lichens. The species *L. tartarea* is the principal lichen used in the preparation of the dye called *cudbear*. *L. esculenta* and *affinis* form important articles of food to man and the lower animals in Persia, Armenia, Tartary, &c. They sometimes appear in such enormous quantities as to cover the ground to the depth of several inches.

LECTUALIS, *lek-tu-a'-lis* (Lat., *lectus*, a bed).—A term formerly applied to diseases which confined the patient to bed, and detained him there for some time. The patients themselves would be called "lectuales" when they were confined to bed for a lengthened period by obstinate disease.

LECYTHIDACEÆ, *le-se-thi-dai'-se-e.*—The Brazil-nut or Monkey-pot order of plants, sub-order *Mystaceæ*. They are large trees, principally natives of Guiana and Brazil, and are remarkable for their large woody fruits, the pericarps of which are used as drinking-vessels &c. (*See* BERTHOLLETIA.) The flowers are large and showy. The typical genus is the Lecythis, the fruits of *L. ollaria* and other species are termed *monkey-pots*, and contain large, edible seeds, some of which have lately been imported under the name of Sapucaya nuts. The bark of some species of lecythis separates into thin papery layers, which are used as wrappers for cigarettes by the Indians.

LEDUM, *le'-dum* (from Gr., *ledon*, a plant now called *Cistus Ledon*).—A genus of the natural order *Ericaceæ*, sub-order *Rhodoreæ*. They are small, evergreen shrubs, with large flowers. An infusion of the leaves of *L. palustre* and *latifolium* is used in North America as a substitute for China tea, under the name of Labrador tea, or James's tea. The leaves possess narcotic properties, and are regarded as useful remedies for ague, dysentery, and diarrhœa.

LEECH, *leetsh* (Sax., *laccan*, Lat., *hirudo*, from *haurio*, I draw)—A genus of red-blooded worms, or annelid animals of the order *Suctoria*, and forming the family *Hirudinidæ*, having an oblong body, with a sucker at one end and a mouth at the other. In the mouth there are three small jaws, tongues or plaits of skin, by which they are enabled to extract the blood of other animals, which form their principal nourishment. Leeches are oviparous, and take nearly five years to arrive at maturity. They are found in ponds and rivers in nearly every country; and derive their chief interest from their use as a remedial agent. The species generally employed for medical purposes belong to the genus *Sanguisaga*. Of this genus two species are employed in Europe—*S. officinalis*, the Hungarian, or green leech, used in the south of Europe, and the *S. medicinalis*, the German, brown speckled or English leech, used in the north of Europe; the latter variety is now rare in this country, on account of the draining of so many marshes, bogs, and ponds, where it was formerly abundant. The same is nearly the case in France, which is now principally supplied from the frontiers of Turkey and Russia. The large number of leeches used in England are mostly imported from Hamburg and the south of Europe. The English, or speckled leech, is composed of from ninety to one hundred rings, and is convex on the back, which is olive-green in colour, with six red, longitudinal stripes, spotted with black. The belly is flat, greenish-yellow, and spotted with black. The oral and caudal extremities are narrowed before they spread out into discs or suckers, and the anterior extremity is rather narrower than the caudal. The sucker at the tail is an organ of prehension or holding, by which the animal is enabled to progress. The leech breathes by pores, which open into small vesicles ranged on either side. The stomach occupies two-thirds of the length of the animal, and is divided into eleven compartments, each furnished with two cæcal sacs; it is closed by a sphincter valve at its lower end. The leech has no heart, but four large pulsating vessels instead, one on each side, one on the dorsal and the fourth on the abdominal surface. In its native abode, the true medicinal leech seems to take no solid food, but subsists entirely on the fluids of fish, frogs, &c. They are caught in various ways—by the hand, or by a person wading in the shallow waters during the spring season, when they adhere to his naked legs; but in summer, when they retire to deeper water, a raft is constructed of twigs and rushes, by which a few are entangled. They are sometimes taken by means of decayed animal matter or liver, as bait; but this method is considered injurious to the health of the animal. If active in the water, and plump when taken out, a leech may be known to be in good health. Leeches vary in the quantity of blood which they can abstract—from one drachm to half an ounce, and from one to two drachms, is the average. When forcibly pulled away whilst sucking, the leech is very apt to leave the teeth, or plaits of skin, in the wound, giving rise to pain and inflammation of the part; the leech is also rendered incapable of biting again. One of the most certain methods of making leeches bite is to cleanse the skin thoroughly; and the leeches should be exposed to the air for a short time previous to their application, as by this means they will bite more eagerly. They may be applied to the part by holding them lightly in the fingers, if they are voracious; or they may be placed in a cup, or a narrow tube of glass, which should be inverted over the part from which the blood is to be drawn. A leech should not be disturbed whilst sucking, but should be permitted to fall off. When it has dropped off, it should be seized by the tail, and striped between the finger and the thumb, in order to make it disgorge most of the blood, allowing it to retain about one-third,—this is better than applying salt or vinegar to the mouth; it should then be placed in many successive fresh waters, when it may survive, and after many months be again fit for use. The increasing scarcity of leeches renders their propagation and preservation matters of great importance; and large numbers die through errors in the method of keeping them. Leeches have not been observed to propagate when kept in small bodies of water; but in large reservoirs, with a bottom of turf and rushes and clay sides, in which to deposit their cocoons, they have been known to propagate. The consumption of leeches in this country has greatly diminished of late years, which is one of the many indications that the practice of bleeding is being rapidly abandoned. Immense harm and life-long misery has often resulted from bleeding, especially with leeches, and it is a moot point whether it can ever do real good. At any rate, it should never be resorted to without the most mature medical advice.

Horse Leech, *Hæmopis Sanguisorba*, is larger than the medicinal leech, and is of no value as a blood-sucker. It feeds on worms.

Land Leech.—In most valleys of India, Ceylon, the

Indian Archipelago, and some parts of South America, leeches about an inch long abound, and are very troublesome to pedestrians, horses, and cattle. The coffee-planters wear gaiters of closely woven cloth as a protection.

LEEK, *leek* (Sax., *leac*).—A hardy biennial plant (*Allium Porrum*). Although the leek attains perfection in size and for culinary purposes in the first year, it does not run to seed until the second, the perfecting of which it often also survives. The whole of the plant is eaten, being used in soups, &c., and by some persons is boiled and eaten with meat. There are four varieties—the Musselburgh and the large London leek, which are by far the best; the Scotch, or flag, which is larger and harder; and the Flanders. The leek is raised solely from seed. (*See* ALLIUM.) The leek is the national emblem of the Welsh.

LEG, *leg* (Du., *læg*).—A term commonly applied to the whole of the lower limb from the hip to the ankle, but which properly belongs to that portion which extends from the knee to the ankle, the upper portion being the thigh. (*See* ANATOMY.)

LEGUME, *le'-gu-me.* (*See* LEGUMINOSÆ.)

LEGUMIN, *leg-u'-min* (from Lat., *legumen*, a legume).—A substance similar to casein, found in the seeds of most leguminous plants. Legumin may be extracted from peas or almonds by digesting the pulp of the crushed seeds in warm water for two or three hours. The undissolved portion is strained off, and the turbid liquid allowed to deposit the starch which it holds in suspension; it is then filtered, and the casein is then precipitated by dilute acetic acid in the form of a flocculent precipitate, which is washed, dried, powdered, and digested, first in alcohol and then in ether. It is coagulated by rennet (like the casein of milk), and the Chinese make a kind of cheese from peas and beans.

LEGUMINOSÆ, OR FABACEÆ, *leg-u-min-o'-se.*—A natural order of *Dicotyledones*, subclass *Calyciflorœ*. The order may be generally distinguished by having papilionaceous flowers or leguminous fruit. It is divided into three sub-orders; namely—1. *Papilionaceœ.*—Petals papilionaceous, imbricated in æstivation, the upper or odd petal exterior; as in the pea, bean, furze, broom, &c. 2. *Cæsalpinieœ.*—Petals not papilionaceous, imbricated in æstivation, the upper or odd petal interior; as in the tamarind, cassia, &c. 3. *Mimoseœ.*—Petals equal, and valvate in æstivation; as in the acacia, &c. The leguminous order is not only among the most extensive that are known, but also one of the most important to man, whether we consider the beauty of the numerous species, which are among the gayest-coloured and most graceful plants of every region, or their applicability to a thousand useful purposes. The Cercis, which renders the gardens of Turkey resplendent with its myriads of purple flowers; the Acacia, not less valued for its airy foliage and elegant blossoms than for its hard and durable wood; the Brazilletto, Logwood, and Rosewoods of commerce; the Laburnum; the classical Cytisus; the Furze and the Broom, both the pride of the otherwise dreary heaths of Europe; the Bean, the Pea, the Vetch, the Clover, the Trefoil, the Lucerne—all staple articles of culture by the farmer—are so many leguminous species. The gums Arabic and Senegal, Kino, Senna, Tragacanth, and various other drugs, with Indigo, the most useful of all dyes, are products of other species; and these may be taken as a general indication of the purposes to which leguminous plants are applied. There is this, however, to be borne in mind regarding the qualities of the order in a general point of view—viz., that upon the whole it must be considered poisonous; and that those species which are used for food by man or animals are exceptions to the general rule, the deleterious juices of the order not being in such instances sufficiently concentrated to prove injurious, and being, in fact, replaced, to a considerable extent, by either sugar or starch.

LEMMA, *lem'-ma* (Gr., a thing taken or assumed).—In Mathematics, a term used to denote a preliminary proposition taken as demonstrated for the purpose of being used in the demonstration of a subsequent proposition. Thus, propositions in Geometry may be taken as lemmas to prove some proposition in mechanics.

LEMMING, *lem'-ming.*—The *Myodes Norvegicus* is a native of Norway Finland. It belongs to the family *Murina*, which includes the mouse, rat, and other similar-formed animals. It is about five inches in length, with a tail about half an inch long, and is of a tawny colour, variegated with black. In its habits the lemming is extremely peculiar. It subsists entirely on vegetable food, and lives in shallow burrows underground in summer, and makes long passages under the snow in winter. In Baird's "Cyclopædia of the Natural Sciences," its peculiar habits are thus described:—"The most remarkable feature in the history of the lemming is the periodical migrations the animals make from one part of the country to another. They descend in great bands from the mountains which divide Nordland and Findmark, eating up everything before them. They pursue their course in a straight line, climbing walls and houses, and not avoiding man himself, should he stand in their way, but attempting to climb over him. Rivers and lakes are swum across, the band forming again on the other side, and corn and hay stacks are gnawn through. Like an army of locusts, they pass on, leaving a desolate track behind them; nor do they stop till they reach the sea, where thousands are drowned. During their march great numbers are destroyed by hawks, owls, weasels, &c.; and so great is the havoc thus committed, and by their being swept away in crossing rivers, and by similar casualities, that but few ever reach their native haunts again. The cause of these migrations is not well known, but is supposed to arise from want of food. They appear to take place at irregular intervals; but upon an average about once in ten years." In former times, the lemmings were superstitiously regarded by the peasants of the countries they went over, the popular belief being that they fell from the clouds; and in such dread were they held, that it used to be the custom for priests to exorcise them with bell, book, and candle. Lemmings are also very numerous in the north of Siberia.

LEMNACEÆ. (*See* PISTIACEÆ.)

LEMNIAN EARTH, OR SPHRAGIDE, *lem'-ne-an.*—A species of bole, or kind of earth, found in the island of Lemnos, in the Ægean Sea. Amongst the ancients this substance was celebrated as a sovereign remedy against poisons and the bites of venomous reptiles. It was also much used in medicine, not only as an alexipharmic, but also as an astringent, sudorific, vulnerary, &c. There were three varieties of Lemnian earth—the white, the red, and the yellow, of which the two former were considered the most valuable. In external appearance it resembles a clay, with a smooth surface like agate, especially in recent fractures. It is of a fatty consistence, and has a soapy feel, adheres slightly to the tongue, and falls to pieces when immersed in water. When analyzed, it is found to consist of—silica 66, alumina 14·5, soda, 3·5, oxide of iron 6, water 8·5, with slight traces of magnesia and lime. Till within the present century, the Turks and Greeks believed that the Lemnian earth was possessed of imaginary virtues. The cups and goblets used by the Sultan and chiefs were invariably made of this substance. The alexipharmic and astringent properties of this and other boles are now held in little or no esteem; but, used in the same manner as soap, it is still applied to remove impurities.

LEMON, *lem'-on* (Fr., *limon*, Low Lat., *limonium*).—The fruit of the lemon tree (*Citrus limonum*) was originally brought to this country from the tropical parts of Asia, but is now very extensively cultivated in the south of Europe, and especially in Sicily, where the fruit forms an important article of commerce. The lemon is a variety of the citron, and belongs to the natural family *Amantiaceæ*. The juice of the lemon makes one of the most popular and refreshing beverages—lemonade. The fresh rind of the lemon is a gentle tonic, and when dried and grated, is used in flavouring a variety of culinary preparations. Lemons appear in company with the orange in most orange-growing countries. They were only known to the Romans at a very late period, and, at first, were only used to keep the moths from their garments, their acidity being unpleasant to them. In the time of Pliny the lemon was hardly known otherwise than as an excellent counter-poison. Juice of lemons, as obtained by pressing lemons, is a semi-opaque and extremely sour fluid, the elements of the sourness being citric and nitric acid. It is used in medicine as an anti-scorbutic, and also in certain cases of rheumatism. On board ship during long voyages, it is of great value as a preventative of scurvy, but lime-juice is even more effectual.

LEMON-GRASS OIL. (*See* ANDROPOGON.)

LEMUR, *le'-mur* (Lat., *lemur*, a ghost).—A term formerly applied, in the Linnæan system of zoology, to several of the lower quadrumanous animals of different structure and habits. However, it is now restricted to such as have the inferior incisors long, compressed, and sloping forwards, and the lower canines approximated and of similar form and direction. "Each of the four extremities is provided with an opposable thumb; but the index digit of the hinder hand has its nail developed into a long, curved, sharp-pointed claw." The lemurs are natives of Madagascar, and of some of the smaller islands in the immediate neighbourhood. Their food is composed of a mixed diet of fruits, insects, and small birds, they being able to surprise the latter while at roost during the night-ttime. (*See* FLYING LEMUR.)

LENITIVES, *len'-e-tivs* (Lat. *lenis*, gentle). In Medicine, a term applied to purgatives which act in a gentle manner, and have a soothing effect.

LENTIBULARIACÆ, *len-te-bu-la-re-ai'-se-e*.—In Botany, the Butterwort family, a small natural order of *Dicotyledones*, sub-class *Corolliflorœ*, consisting of herbs growing in water, marshes, or wet places. The leaves are radical, entire, or divided into thread-like filaments, bearing little pouches or air-vesicles. The flowers are irregular, with persistent 2-lipped calyx, and a 2-lipped corolla. The species *Pinguicula vulgaris* is termed butterwort, from the property its leaves possess of coagulating milk.

LENTIGO, *len-tee'-go* (Lat.)—In Medicine, a freckle on the skin, so named from its resemblance to lentil-seeds.

LENTILS. (*See* ERVUM.)

LENZ'S LAW, in Electro-Dynamics, is thus described:—"Whenever a relative displacement takes place between a current and a closed circuit in a natural state, the latter is traversed by an induced current, which reacts so as to determine a motion in the opposite direction, or, what comes to the same thing, which is opposite to the current that would produce the same displacement."

LEO, *le'-o* (Lat., *leo*, the lion).—A constellation of the northern hemisphere, which gives its name to the fifth sign of the zodiac. It is situated between the constellations Ursa Major, or the Great Bear, Virgo, and Cancer. The most conspicuous stars in this group are Regulus, or α Leonis, of the first magnitude, and Deneb, or β Leonis, of a magnitude midway between the first and second, which is intersected by a straight line drawn through the pole-star and the star γ in Ursa Major.

LEO MINOR, or the Little Lion, a constellation of the northern hemisphere, formed and named by Helvetius, lying immediately to the south of the Great Bear, and between Lynx, Leo, and Cancer. It is composed of small stars, all of them being less in apparent size than stars of the fourth magnitude.

LEOPARD, *lep'-pard* (*Felis leopardus*).—A name applied to the larger spotted cats (*Felidæ*), which are found both in the Old and New Worlds. In the continent and islands of the Old World, the leopard appears to have its most perfect development; but the American jaguar far excels the leopards of Asia and Africa in size, strength, and sturdiness of make. There is much discrepancy of opinion among naturalists as to whether the leopard and panther (*Felis pardus*) are distinct species or only varieties. Cuvier separated the panther from the leopard specifically. He describes the panther as being yellow above and white beneath, with six or seven rows of black spots, formed by a cluster of five or six simple spots on each side. He speaks of the species as being found all over Africa, in the warm countries of Asia, and in the Indian Archipelago. The leopard is referred to as differing from the panther in having ten rows of smaller spots. Linnæus, however, could not see sufficient grounds of distinction between them, and referred both names to one and the same animal (*Felis leopardus*). The leopard, properly so called, is a beautiful but savage animal, and is spread over the African continent as widely as the lion. Over this vast extent he varies little, and that merely in magnitude and in the size and form of his markings and their depth of colour. Everywhere, however, he is the same in respect to form and structure, disposition and character. The general colour of the leopard is yellowish fawn, which grows paler in the sides, till it merges into the white of the under part of the body. Over the head, neck, back, and limbs are scattered black spots of various sizes; while the sides are covered with numerous rose-shaped spots. The leopard's general aspect and disposition is characterized by all the ferocity and craftiness which is noticed in the rest of the cat tribe. He preys upon antelopes, monkeys, and the smaller quadrupeds, but avoids man, except when closely pursued, when he fights obstinately. Leopards have been known to attack solitary travellers. When they fall in with a flock of sheep, they commit almost incredible slaughter. Two leopards, a male and female, with three young ones, have been known to enter a sheep-fold near the Cape of Good Hope, when the old animals killed nearly a hundred sheep. After having gorged themselves, they fed their young, and each seizing a whole carcass, tried to carry it away; they were waylaid, however, and killed. The mode by which the negroes capture the leopard is by digging pitfalls and slightly covering them with hurdles, over which a piece of meat is laid as a bait. From the great flexibility of the limbs of this animal, he is able to ascend trees with great ease, and when pursued, is in the habit of taking refuge among the branches. He can be somewhat tamed when taken very young. According to the accounts of African travellers, the flesh of the leopard is excellent, resembling veal in flavour. The skins are valuable for making rugs, &c., and are sold in Europe at from £5 to £10. Among the larger spotted cats of the Old World is the Rimau-dahan, which partakes, in some measure, of the markings of the tiger and leopard, though it seems to be more allied to the former than to the latter. Its probable size, when full grown, will be about four feet from the nose to the root of the tail; and its height, at the shoulder, about one foot ten inches. Its colour is brownish-grey, with no yellow or red tints. Its spots and stripes are large, dark, irregular, and oblong in form; the larger ones being marked by lines of velvety black. It inhabits Sumatra. The natives assert that the rimau-dahan never attacks man, but lives principally upon poultry, birds, and the smaller kinds of deer; and that it sleeps, and often lays in wait for its prey on trees; from whence it derives the name of *dahan*, which signifies the fork formed by the branch of a tree. One of the most interesting forms of division of the *Felidæ* is the cheetah, or hunting leopard (*Cynailurus jubatus*). (*See* CHEETAH.) The jaguar (*Felis Onça*), or American panther, is the form which the leopard takes in the New World. (*See* JAGUAR.)

LEOPOLDINA, *le-o-pold-in'-e-a* (so named after the empress of Brazil).—In Bot., a genus of Palms. *L. Piassaba* is a very interesting and useful plant. Its persistent petiole-bases terminate in long, pendulous beards of bristle-like fibres: these are cut off from the young plants after having been previously combed out by means of a rude comb, and now form an important article of commerce in Brazil. These fibres are known under the names of Pissaba or Piacava, paragrass and monkey-grass, and are used for brooms, cleaning-brushes, &c. The pulpy envelope of the fruit yields a delicious drink resembling cream.

LEPIDODENDRON.—A genus of fossils indicative of once-living trees found in the strata of coal. They are believed to be the remains of gigantic mosses, but other investigators consider that they were pine trees.

LEPIDOLITE, *lep'-e-do-lite* (Gr., *lepis* a scale; *lithos*, stone).—In Min., a mica containing lithia, rubidia, and cæsia. It is generally employed as the source of these rare alkalies.

LEPIDOPTERA, *lep-e-dop'-ter-a* (Gr., *lepis*, a scale; *pteron*, a wing).—An order of insects which contains those generally known by the name of butterflies and moths. They have four membranous wings, covered on both sides with minute, generally coloured, scales, which appear to the naked eye like a quantity of fine dust scattered over them. They possess also a long proboscis, or trunk, rolled up spirally; and two antennæ, generally long, of variable form. The Lepidoptera undergo perfect metamorphosis. In general, the females are rather larger than the males, and their colour less brilliant. In the *imago* state they are very short-lived; the males die shortly after the act of generation is accomplished, and the female soon after she deposits her eggs. The nectar of flowers forms their principal food, and they suck it up from the depths of the narrowest blossoms by means of their proboscis, which is wonderfully adapted for the purpose. The females of different species lay their eggs upon different plants, according to the proper food required for the young caterpillar. Thousands of eggs are sometimes laid by one insect, and they are made to adhere to the surface of the leaf on which they are deposited. The larvæ of the Lepidoptera are well-known by the name of caterpillar. When ready to be hatched, they come out in a worm-like form, the body being cylindrical, and composed of thirteen segments. They have three pairs of simple articulated feet, which serve the purpose of walking; and from two to five pairs of false legs, short and thick, armed at the end with hooks, which enable the animal to fasten itself on leaves, branches, &c. Most of these larvæ move forwards, but some walk backwards, with a sort of leaping motion; while others draw the body into a loop-form, then suddenly straightening, spring forwards with an energetic bound. During this state of their existence, they do considerable damage to trees, shrubs, &c., and change their skin several times. They then cease feeding, and change into the chrysalis or pupa state. (*See* INSECT-TRANSFORMATIONS.) When the perfect insect emerges, the wings are at first moist and unexpanded; it then appears weak; but soon after being exposed to the air its wings become dry and expand, and the insect seems full of life and activity. There are supposed to be about 12,000 species of Lepidoptera, or nearly one-sixth of all the insect tribes. More than 2,000 are said to be natives of Britain. They present many points of interest to the entomologist, especially in their larva and their pupa state; while the beauty and elegance of the forms of the perfect insects are admired by all. The value of the silk cocoons of the pupæ of certain species is almost equal to the damage done by the larvæ of others. The Lepidoptera have been divided into three large classes: the *Diurna*, or those which fly by day; the *Crepuscularia*, or those which fly in the evening; and the *Nocturna*, or those which fly by night. Many of the Nocturna, however, fly by day, and *vice versâ*; in consequence of which another arrangement has been adopted, based upon the construction of the antennæ. In the butterflies, the antennæ are always club-shaped at the extremity; they are therefore classed in the group *Rhopalocera*, club-horned. The moths, on the contrary, never have the antennæ with club-shaped ends; they are generally cetaceous, filiform, or pectinated; they have consequently been classed in the group *Heterocera*, varied-horned.

LEPIDOSIREN, *lep'-e-do-si-ren* (Gr. *lepis*, a scale), the Mud-eel, an animal which in late years has given rise to much discussion among naturalists, as to whether it belongs to the class of reptiles or fishes. It is one of the most perfectly amphibious of all animals. Its organs of respiration are twofold. As in all fishes, it has well-organized gills on the inner edge of the branchial arches, and a regular gill-cover, with a small oblong aperture in front of the base of the anterior members. Besides these, it has two well-developed cellular lungs of nearly equal size. The body is elongate and fish-like in form, covered with oval imbricated scales, and furnished with dorsal and caudal membranes resembling fins, strengthened with soft-jointed rays. According to the supporters of the reptilian theory, these members are feet, while those who regard the animal as a fish look upon them as fins. Two species of Lepidosiren are known—the *L. paradoxa* and the *L. annectans*: the former is found in the Amazon and the latter in the Gambia. Several living specimens of the animal found in the Gambia have been brought to this country. During the inundations of the river, large portions of country are flooded; upon the retreat of the waters, the lepidosirens that are left behind burrow into the mud. The sun soon converts this into a hard cake, and they remain cased up in a sort of cocoon of dried mud. They remain torpid, and covered with a thick secretion of mucus, till the rainy season again commences, and the flooded river releases them. The natives eat the lepidosirens, and it is said that, when fried, they closely resemble eels in taste, and have a rich, oily flavour.

LEPIDUM, *lep'-e-dum* (from Gr., *lepis*, a scale), in Botany, of the natural order *Cruciferæ*. *L. sativum* is the garden cress, well known as a pungent salad, being commonly used with the young herb of the mustard-plant. (*See* SINAPIS.)

LEPRA, OR LEPROSY, *lep'-ra*, *lep'-ro-se* (Gr., *lepra*, scaliness).—In Medicine, is a disease characterized by the formation of scaly patches on the skin, of different sizes, but having always nearly a circular form. Physicians distinguish three varieties of this disease—*Lepra vulgaris*, or common leprosy; *Lepra alphos*, or white leprosy; and *Lepra nigricans*, or black leprosy. Leprosy first manifests itself in small, distinct reddish elevations of the cuticle, which enlarge till they sometimes attain the size of a crown-piece. They are covered with scales, which accumulate and form a thick, prominent crust, and are quickly reproduced as they fall off. This disease usually makes its appearance first about the knee or elbow, and extends by degrees along the extremities, till sometimes the whole body becomes affected by it. Its progress is, in general, very slow, and it may continue in the same state for years. The general health of the patient is but little disturbed by this disease. In lepra alphos the scaly patches are smaller than in lepra vulgaris, and have also their central parts depressed or indented. The lepra nigricans differs from the others chiefly in the colour of the patches, which are dark and livid. This disease sometimes makes its appearance without any apparent cause, sometimes it may be induced by exposure to cold or damp, and sometimes it is evidently hereditary. It is generally tedious of cure. This disease appears to have been much more prevalent and of a severer type, in ancient than in modern times, if indeed this is the same disease—many being of opinion that the leprosy of ancient times resembled rather what is now known as elephantiasis. (*See* ELEPHANTIASIS.)

LEPTOSPERMEÆ, *lep-to-sper'-me-e* (Gr., *leptos*, slender; *sperma*, a seed).—In Botany, a tribe of the natural order *Myrtaceæ*, characterized by having capsular fruit. The typical genus is *Leptospermum*, two species of which, *L. scoparium* and *thea*, have leaves which are used in the Australian colonies as a substitute for tea.

LEPUS. (*See* HARE.)

LEPUS, *le'-pus* (Lat., *lepus*, the hare).—One of the original constellations of Aratus and Ptolemy, situated in the northern hemisphere, to the south of Orion. Its most considerable stars are of the third and fourth magnitude.

LERNEADA, *ler-ne-a'-da*, are Crustacea, having their mouths adapted exclusively for suction. They were placed by Cuvier amongst the Entozoa. They appear as parasites on various fishes, sometimes adhering to them in such numbers as to render them blind.

LESION, *le'-zhe-on* (Lat., *lædo*, I hurt).—In Surgery, is a term used to denote any kind of wound or bodily injury.

LETHARGY, *leth'-ar-je* (Gr., *lethe*, forgetfulness; *argia*, inactivity), is a state of unnaturally profound and continuous sleep. It is intermediate between heavy sleep and a state of complete coma, and may result from severe exertion of the body or mind; but it is also frequently produced by congestion of blood in the vessels of the brain; and hence it is often a symptom of great danger, frequently preceding an attack of apoplexy. It may also be caused by the action of any narcotic substance, or of alcoholic liquors. (*See* APOPLEXY, COMA.)

LETTUCE, *let'-tus* (Fr., *laitue*), first grown in England, 1540, a smooth, herbaceous, annual plant, containing a milky juice, which has been cultivated from very early times. It is much used as a salad. There are many varieties of cultivated lettuces, which are divided into two families—the cos and the cabbage. The cos varieties are distinguished by being of an upright growth, and are more grown in summer than in winter. The cabbage lettuce is grown at all seasons, but more especially in winter, on account of its superior hardihood. It grows close to the ground, and produces a blanched heart, like the cabbage, without assistance. When young, the cabbage varieties are generally sweeter than those of the cos at the same age, but at full growth this is reversed; hence the latter are preferred for salads, and the former for soups. (*See* LACTUCA.)

LEUCINE, *lu'-sine.*—In Chemistry, a substance formed during the decomposition of cheese, muscle, or gluten, in the presence of water. It forms crystalline salts with several of the acids. It is somewhat cholesterine in appearance. It is sparingly soluble in cold water, but readily so in hot. It has an unctuous feel, and sublimes at 340° in woolly flocculi.

LEUCISCUS, *lu-sis'-kus.*—The genus of fresh-water fish, in which is contained club, dace, ide, minnow, and roach.

LEUCOCYTHEMIA, *lu-ko'-si-the'-me-a.*—A disease of the blood, the effect of which is to increase the number of white corpuscles and to diminish the number of red ones. It is sometimes called White Blood.

LEUCOMA, *lu-ko'-ma* (Gr., *leukos*, white).—In Medicine, is applied to a white opacity of the cornea of the eye. It is occasioned by acute inflammation, causing a deposition of lymph either upon the surface or into the substance of the cornea. When merely superficial, it often passes away with the cessation of the inflammation, but when deep-seated it is often incurable. Astringent lotions are generally recommended.

LEUCOPOGON. (*See* EPACRIDACEÆ.)

LEUCORRHEA, *lu'-ko-re'-a.*—A white discharge peculiar to females.

LEVATOR, *le-vai'-tor* (Lat., *levo*, I lift up). —In Anatomy, a name given to certain muscles which serve the purpose of lifting the parts to which they are attached.

LEVERET.—A hare not exceeding a year old.

LEVISTICUM, *le-vis'-te-kum* (a corruption of *ligusticum*, from Liguria, a place in Italy where it was abundant).—In Botany, a genus of umbelliferous plants. The species *L. officinale*, the lovage, was once much used as a potherb, and as an ingredient in salads. The fruits (commonly called seeds) have somewhat similar properties to those of the dill and caraway.

LEWISIA, *lu-is'-e-a* (in honour of Captain Lewis, who accompanied Clarke to the Rocky Mountains).—In Botany, a genus of the natural order *Mesembryaceæ*. The root of *L. rediviva*, an American species, is eaten in Oregon. It is sometimes called tobacco-root, from the smell which it acquires by cooking. M. Geyer states that it is the *racine amère* of the Canadian voyageurs. When cooked it is agreeable and wholesome.

LEXELL'S COMET, *lex-'els.*—One of the short period comets, with notable characteristics.

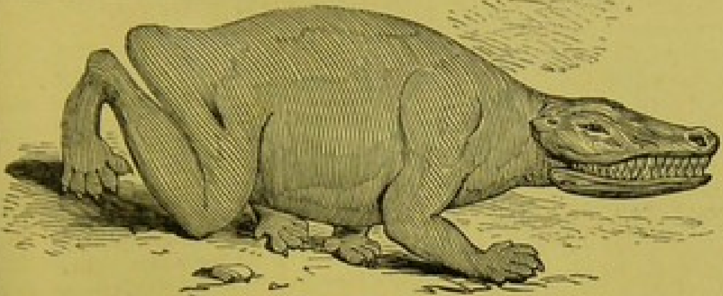
LIAS, *li'-as.*—A term applied in Geology to denote a peculiar formation, consisting of thick argillaceous deposits, which constitutes the foundation on which the oolite series rests. The word *lias* is believed to have had its origin in a provincial mode of pronouncing the English word *layers*. To a considerable depth the upper portion of these deposits consists of beds of deep-blue marl, containing a few irregular beds of limestone. In the lower portion, however, the limestone beds increase in frequency, and assume the characteristic aspect of lias, presenting a series of thin, stony beds, separated by narrow argillaceous partings, so that the quarries of this rock assume a striped or ribbon-like appearance when viewed from a distance. When in their purest state, these limestone beds contain about 90 per cent. of lime, the other constituents being alumina, iron, and silica. The lime afforded by the blue lias is strong, and is distinguished by having the property of setting under water. The lias clay often occurs in the form of soft slate or shale, which divides into thin laminæ, and is frequently impregnated with bitumen and iron pyrites. In consequence of this, when laid in heaps with faggots and set on fire, it continues to burn till the pyrites are decomposed. It also ignites spontaneously when it falls in large masses from the cliffs on the sea-shore and becomes moistened. The alum slate of Whitby is of this kind. The whole of the lias formation is rich in fossils, and is remarkable for its numerous remains of chambered univalves and bivalves, and certain species of fish and vertebral animals allied to the order of lizards, some of which are of enormous size. The ichthyosaurus and plesiosaurus were amongst these. (*See* ICHTHYOSAURUS, PLESIOSAURUS.) The lias crosses England from Whitby, in Yorkshire, to Lyme, in Dorsetshire. Its most valuable productions are water-setting lime and alum shale. A similar formation is found in France, in the Alps, and the Jura.

LIBELLULA, *li-bel-lu-la.* (*See* DRAGON-FLY.)

LIBER, *li'-ber* (Lat., bark).—A term used in Botany to denote the interior lining of the bark of exogenous plants. In this part of the bark only the woody or longitudinal tissue occurs. In many instances it is very abundant, and exceedingly tough and thick-sided, in consequence of which it is of great value for many useful purposes. When freed from the cellular tissue adhering to it, it is often manufactured into cordage, especially in trees and shrubs of the natural order *Malvaceæ*. The useful articles commonly called Russia mats are made from the thin laminæ into which the *endophlœum* of the lime tree (*Tilia Europæa*) readily separates. The lace-bark of Jamaica, remarkable for its beautiful lace-like appearance when pulled gently in a lateral direction, and for its great toughness, is the laminated liber of *Lagetta lintearia*: in consequence of its latter quality, it is twisted into whiplashes. The liber appears to be formed annually, at the same time as the concentric zones of wood, and is intended by nature to convey downwards the secretions elaborated in the bark and leaves. The term *bass*, or *bast*, is applied by gardeners to the liber of the lime-tree, which is used for making packing-mats, and also for binding up bunches of flowers, &c.

LIBRA, *li'-bra* (Lat., *libra*, the balance), a constellation which gives its name to the seventh sign of the zodiac. It seems to have once formed a part of the constellation Scorpio, which then occupied two signs of the zodiac, the body being in one part, and the claws, now called Libra, in the other. It lies between Scorpio, Virgo, the Centaur, and Lupus. Its largest stars are of the second magnitude. The sun enters Libra at the commencement of the vernal equinox, and the name was probably given to this constellation and sign of the zodiac in allusion to the equality that exists at that time between day and night.

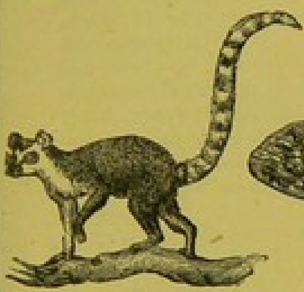
LIBRATION OF THE MOON, *li-brai'-*



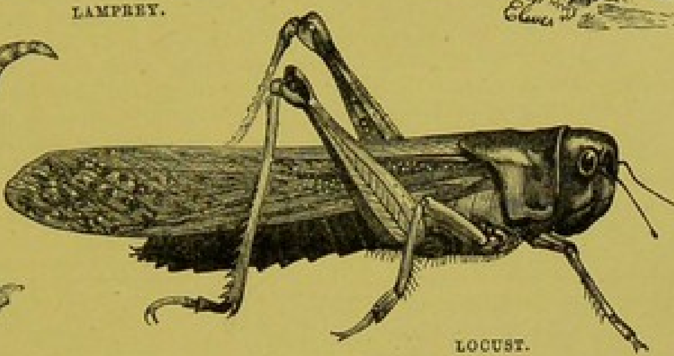
LABYRINTHODON.

LAMPREY.

LYNX.



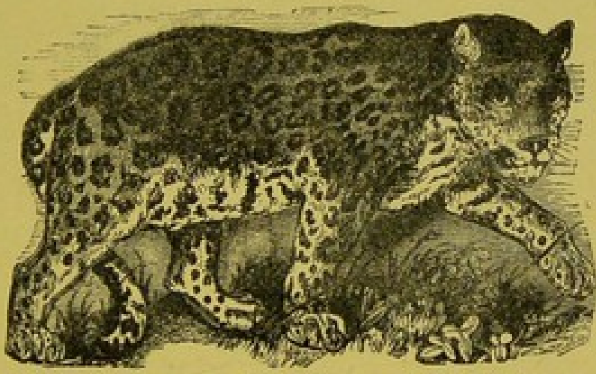
RINGTAILED LEMUR.



LOCUST.

LIME TREE.

LOOSE-STRIFE.

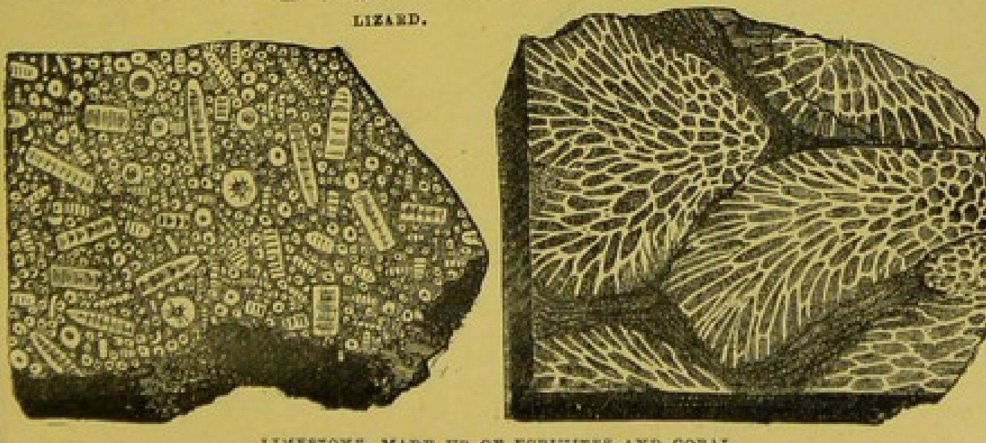


LEOPARD.

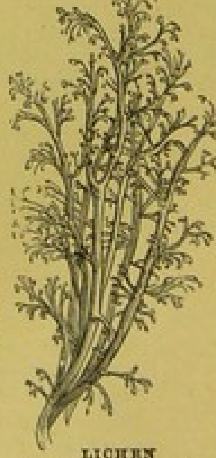
LEGUME.

LILY.

LIZARD.



LIMESTONE, MADE UP OF ECRINITES AND CORAL.



LICHEN
(TRIPE-DE-ROCHE).

shun (Lat., *libra*, a balance).—The term libration signifies a slight oscillation or rocking motion from side to side of a certain position, the body in libration inclining first to one side and then to the other, as any body will do whose equilibrium has been disturbed. The expression "libration of the moon" is applied to an irregularity in the moon's motion, through which the moon does not at all times present the same face to an observer on the earth's surface. The moon accomplishes her revolutions about her axis and in her orbit in the same *mean* time. Now, if the moon's motion in her orbit were uniform at all times during the period of revolution, and if the plane of her equator passed through the centre of the earth, the moon would always exhibit the same face to an observer in that position; but as this is not the case, and as the moon's orbital motion is irregular, the axis of the moon does not always preserve the same inclination to an observer on the earth, but appears to have a slight oscillatory motion, through which very small crescent-shaped portions of the moon's surface, at all parts of her circumference, north, south, east, and west, are alternately presented and withdrawn from view at regular periodic times.

LICHENES, LICHENS, *li'-ken-eez, li'-kenz*, or *litsh'-e-neez, litsh'-enz* (Gr., *leichen*).—In Botany, the Lichen order of thallogenous *Acotyledones*, consisting of perennial plants, composed of parenchymatous cells, arranged so as to form a foliaceous, somewhat woody, scaly, crustaceous, or leprous thallus, living and fructifying in the air, and growing on the bark of trees, on old palings, walls, rocks, &c.; usually epiphytic, but sometimes parasitic, and commonly presenting a dry, shrivelled, more or less lifeless appearance. Lichens are distributed over all parts of the world, and form a considerable proportion of the vegetation of the polar regions and mountain-tops. Many species possess nutritive properties from containing starchy matter, such being also emollient and demulcent. Others contain bitter principles, which render them tonic and astringent. Several, again, are important as dyeing agents. None are known to be poisonous. (*See* CETRARIA, LECANORA, ROCELLA.)

LICHENIN, *litch'-nin*.—A starchy substance of a gelatinous character, obtained from Iceland moss. It is available as ordinary starch.

LICHTENBERG'S FIGURES, *litch'-ten-berg*, in electrical science, show the difference between positive and negative currents with reference to non-conductors. One of the observations is that if red lead and sulphur be mixed and dusted over an electric plate, the red lead becomes charged positively and the sulphur negatively.

LIENIN, *le-en-in*.—A substance found in the fluid of the spleen. Its elements are carbon, hydrogen, nitrogen, and oxygen.

LIENTERIA, *le-en-te'-re-a* (Gr., *leitos*, smooth; *enteron*, the intestine), is a species of diarrhœa in which the food passes through the body in an almost unaltered state. (*See* DIARRHŒA.)

LIFE, *life* (Sax., *lif, lyf*), is defined to be that "state or condition of a being that exhibits vital actions;" and it is thus placed in opposition to the term death, which implies the state of a being in which those actions have altogether ceased, and whose structure is subject to no other forces than those of inorganic matter, which speedily effect its decomposition. Life commences with the first production of the germ; it is manifested in the phenomena of growth and reproduction; and it terminates in the death of the organized structure, when its component parts are disintegrated more or less completely by the operation of the common laws of matter. Life is thus "the sum of the actions of organized being." It includes all those phenomena which it is the province of the physiologist to consider. The changes exhibited by any one living being, in its normal condition at least, have one manifest tendency—the preservation of its existence as a perfect structure. By these it is enabled to counteract the ever-operating influence of chemical and physical laws, and to resist to a greater or less extent the injurious effects of external agencies. In the investigation of vital phenomena, the fact has been too much overlooked, "that we always find a similarity of action when the organized structure on the one hand, and the stimuli which call its properties into activity on the other, are identical; and a difference in either of these conditions always produces a difference in the result." We do, indeed, occasionally find variations in the result, without being able to detect any change in either of the conditions; but knowing how very imperfect our powers of discovering minute changes at present are, and bearing in mind that every increase of our means of observation has gone to strengthen the force of our rule, we cannot look upon them as exceptions. In attempting to reduce the mass of phenomena presented to us by vital actions to distinct classes, we find that all living beings introduce into their own structure alimentary substances derived from external sources; and likewise that all submit their fluid ingredients to the influence of the element which they inhabit, so as to produce a reciprocal change between them. Thus, the function of respiration is essentially the same throughout the whole organized world. Hence we conclude that the action of each particular organ is dependent upon the excitation of its properties by agents external to it. When these stimuli are withdrawn, vital action ceases. Further, every class of organs in the living body may be said to require its particular stimulus for the display of its properties. There are also other conditions of a more general nature necessary for the support of vital actions. All vital actions require a certain amount of heat for their performance, and this amount varies in different cases. Light, again, is essential to many others, especially in the vegetable kingdom. Electricity is also an important agent in the vital economy; but our knowledge of its operations is still very imperfect. Many physiologists argue for the existence of a distinct set of vital affinities, from the fact that the tissues and fluids which maintain a certain composition when possessed of vitality, rapidly resolve themselves into new combinations when this has become extinct; but there appears to be more reason to infer that the preservation of the normal constitution of organic compounds in the living body is dependent on the continuance of the vital actions of the economy, rather than due to its mere possession of the property or vitality. In fact, it may reasonably be maintained "that the vitality of each issue, that is to say, its possession of vital properties, is dependent on the perfect condition of the organization; and that, so far from preserving the organism from decay, it merely remains until decay has commenced. There are many organized beings, at particular periods of whose existence all vital action seems to be suspended; and this may result either from the absence of the stimuli necessary to maintain it, or from some change in the organism itself, by which it is, for a time, less capable of responding to these stimuli. The former is manifested in a remarkable manner in the case of seeds of plants, which have been found to preserve their vitality during many centuries; the latter, in the case of certain animals, which pass the winter in a state of torpor.

LIGAMENT, *lig'-a-ment* (Lat., *ligamentum*).—In Anatomy, is a strong elastic membrane connecting the extremities of movable bones. They are divided into capsular and connective, the former surrounding the joints like a cap.

LIGATURE, *lig'-a-ture* (Lat., *ligatura*).—In Surgery, is applied to anything used in binding any part of the body. More particularly it is applied to the thread or silk used in the tying of arteries or veins that have been cut. In such cases, ligatures should admit of their being tied with some force without the risk of breaking.

LIGHT, *lite*.—As familiarly observed, may be described as the medium through which the existence of things is manifested to us through the sense of sight. There are records innumerable of ancient speculations into the properties of light, most of which are merely curiosities of no utility. The first tangible and useful notions about light seem to have been propounded by Sir Isaac Newton, who introduced the proposition that light consists of minute particles emitted from luminous bodies and projected into space with incomparable velocity, which has been followed up by subsequent disclosures arising out of laborious observations. The natural sources of light, which are apparently inextinguishable and perpetual, are the sun, the fixed stars, and, as some investigators contend, the meteors. These sources of light are expressly distinguished from the moon, the planets, and perhaps the comets, the two former certainly, and the latter possibly, being only reflectors of the light of the sun. To the natural sources of light referred to may also be added phosphorescent bodies which give a subdued but independent light. Artificial and occasional sources of light are very numerous. These may arise out of some or any form of combustion producible by chemical action, or by the application of heat in any intense form, or by a current of electricity, or by friction, percussion, or the concentration of the rays of the sun. By these means light may be produced from solid, liquid, or gaseous bodies. Solids become luminous at a much lower temperature than gas, and give off more light at any stated temperature than gas does. Flame is defined as incandescent gas, the purer the gas the less the light, it being demonstrated that the brighest flames are those which contain the largest proportion of solid particles in transit, and derived from the solid matter in course of combustion. From this it is assumed that the intense heat and light of the sun is due to incandescence rather than to flame of any kind; and observations prove that the luminous atmosphere of the sun contains in suspension numerous metals, and the like properties are attributed to the light of the fixed stars. Under special conditions many bodies emit a limited amount of light unaccompanied by heat. Whether this is always due to the presence of phosphorus is not certain, but, in the absence of any other explanation, the phenomenon is usually ascribed to phosphorescent action of a subtle character. The illuminating power of phosphorus is due to its slow combustion on exposure to the atmosphere, when it gives off vapours that are invisible in the presence of brighter light, but are seen in the dark as a faint light with a bluish tinge. This phosphorescent light is evolved from decayed animal and vegetable substances, sometimes from dead wood, and especially from putrid fish. The brightest of the red and yellow flowers growing upon living plants are sometimes observed to give off sudden flashes of light, generally soon after sunset on summer evenings. The growing leaves of the *Phytolacca decandra* sometimes emit a bluish-green or yellowish-green light at night with a shining effect. Some plants which grow in mines and other subterranean places give off a considerable amount of light. The glow-worm and fire-fly are living examples of this emission of light, and it is also observable in many kinds of shell-fish. If a powerful charge of electricity is passed through a lump of sugar it will afterwards emit a violet light. The light produced by electricity is due to the resistance given to it by non-conductors—substances that are bad conductors, usually called refractory (that is, obstinate) substances, because they resist the current and so create a kind of friction. (*See* ELECTRIC LIGHTING.) The source of every light gives off countless particles in all directions, and their rapid passage causes visible rays; hence light is said to radiate. The tendency of every ray is to proceed upon a perfectly straight line, but the resistance of the atmosphere or whatever media it may pass through, creates a wave motion, not discernible to ordinary observation, but which is demonstrated by scientific investigation. Theoretically, the intensity of light is greater in proportion to the degree of vibration of the waves of motion. The first demonstration of the velocity of light is ascribed to Römer, an astronomer of Denmark, who arrived at his conclusions by observation of Jupiter's satellites in 1676; and this has since been regarded as the primary test. From this and other observations it is established that light travels at the rate of 167,600 miles per second. At such rate it is calculated that a ray of light takes to reach the earth from the sun 8 min. 13 sec.; from Neptune, 4 hours 10 min.; from the nearest fixed star (61 Cygni), 10 years. The secondary means of testing this velocity of light are numerous. It is got at by observations of the fixed stars in relation to the motion of the earth; it can be measured by the revolutions of a wheel contrived for the purpose, or by a revolving apparatus fitted with a spherical mirror. Light travels much faster through air than through water or glass. The intensity is governed by three distinct conditions—the distance of the light, the medium through which it is received, and the angle at which it arrives at the object. In some manner not satisfactorily explained, the tendency of a ray of light is to exhaust itself in its progress by some means of gradual absorption, or this may possibly be the result of the separation of the rays wider and wider apart the further they get from their source, whereby, at a given distance, fewer rays shine upon a distant object than when it is nearer. The most universal medium with which we are acquainted is the atmosphere. When a ray passes perpendicularly through the air, it attains its utmost intensity, which is diminished in proportion as the ray becomes nearer the horizontal line; this is owing to the atmosphere causing a deflection of the ray from the straight line which results in a diminution of power. The third condition is the position of the object receiving the ray. Every one knows that the rays of the sun when they shine through a window obliquely produce less light than when the sun is facing the window. It is upon this principle that the light and heat of the sun is so diminished in winter and so intensified in tropical regions, where the sun is overhead at noon or nearly so. The investigation of the properties of light constitutes the peculiar province of optics. This science is completely mathematical (*see* OPTICS); but its basis, like that of all other branches of natural knowledge, must be experiment. The physiological relations of light will be found described in the article EYE; it is only further necessary to say here that the radiant force produces the sensation of light by striking against the expanded nerve of vision—the retina of the eye; and that the effect is persistent during a definite portion of time. Hence it is that winking with the eyelids forms no impediment to correct vision. Experiment has also shown that the impression received by the mind lasts for about the eighth part of a second, but varies with the intensity of the light; so that a luminous point, revolving with the velocity sufficient to complete a circle in that time, will not appear as a fiery point, but a fiery circle. One of the first relations of light to ponderable matter is, that most bodies possess the property of intercepting it in its progress, whilst a few allow it to traverse their substance. From this circumstance arises the distinction of bodies into opaque, transparent, and diaphanous. The light of the sun reaches us freely through a plate of glass, but is entirely excluded by a plate of metal. A sheet of white paper or a piece of porcelain also allows light to pass through it; but not in straight lines parallel to its first direction,—the rays become broken up, as it were, and radiated again from a new self-luminous centre. When an opaque screen is placed between a luminous body and another object, such as a sheet of paper, a shadow is cast which is similar in outline to the section of the body producing it: from this phenomenon we learn that the rays of light are transmitted in straight lines. When a pencil of light traverses space, or a perfectly homogeneous medium, its course is rectilinear and its velocity uniform; but when it encounters an obstacle or enters a different medium, it undergoes certain modifications; it separates itself into several portions: one of these is *reflected*, that is, turned aside, after which it pursues a course wholly exterior to the obstacle or new medium; a second portion enters the medium and is *refracted*, or bent out of its original direction; a third portion is *absorbed*, or lost; and a fourth portion is radiated, or repelled in all directions from the surface. In reflection the primary law is, that the angle of incidence is equal to the angle of reflexion. It is thus that the images are formed in a looking-glass; and as we always see objects in the direction in which the ray of light arrives at the eye, we judge the image to be as much behind the surface of the glass as the object is before it. Every known substance, not excepting air, the most diaphanous of all, reflects some property of light. It is calculated that if a person were plunged 150 feet in the clearest water, he would find the light of the sun no more than that of the moon. When objects are looked at through glass, they become more dim in exact proportion to its thickness. There is, indeed, no such thing in nature as perfect transparency. On the other hand, also, there is no substance possessing the property of perfect reflection; a piece of leaf-gold held up between the eye and any strong light, permits bluish rays to pass through. Light may be so reflected from regular curved concave surfaces that all the rays may converge to a point or focus. In these cases the direction of each ray is the same as if it had been reflected at the point of incidence from a plane surface tangent to the curve. When a ray of light is admitted into a dark room, it may be almost wholly turned aside by reflection from a metallic mirror in any direction, according to the angle at which the mirror is presented to it. If it be made to fall on any object, it will affect that object as the original ray, a portion of it becoming irregularly repelled or scattered. It is this property which renders an object visible in all directions. When this scattered light falls upon other bodies, it is again reflected and dispersed from them, making them visible, but in a less degree, on account of the partial absorption which is continually taking place, and the whole apartment is lighted. If the ray falls on a sheet of white paper, the room will be well lighted, but if upon black velvet, the room will remain dark, since nearly the whole of the light will be absorbed. To ordinary vision this property is of the highest importance. All bodies on the earth possess it in various degrees, and the atmosphere which surrounds it, in a remarkable manner. The sun's light, by this means, is diffused, and that milder radiance maintained which is so agreeable to the eye, and which renders objects visible when the rays do not fall upon them. Without this property all objects shaded from the sun would be totally invisible, and without an atmosphere the sun would appear as a fiery disc in a black sky. Travellers state that on lofty mountains, where the atmosphere is rare, the sun's rays are painfully intense and the sky of the darkest blue, almost amounting to black. When a pencil of light, that is, an assemblage of rays passing from a luminous point, falls on the surface of any transparent uncrystallized medium, a portion pursues its course through it. If it enters perpendicularly, it passes through in a straight line; if at an angle, it is bent from its course, and is said to be *refracted*. In refraction, each different medium has its own action on light; some turning a ray incident at a given angle more out of its way than others. As a general rule, the refractive power of substances is in some degree proportional to their densities: for instance, water acts more powerfully than air, and has its power increased by the solution of different salts; and glass, again, is superior to either. The effect of refraction is familiarly illustrated if a stick be held obliquely in water, when it appears bent at the point of immersion. The direction of a ray of refractive light depends not only upon the surface where it enters, but also at its point of exit. Thus, by modifying the surfaces of reflecting media, the rays of light transmitted can be diverted almost at pleasure. (*See* LENS.) Since the deflecting power acts at the surfaces of bodies, the original deviation of a ray entering a piece of glass may be doubled at its emergence by a proper adjustment of surfaces.

In the case of a triangular prism, the light which falls upon one of the faces is refracted at the first surface, and also at the second; but the second refraction does not bring the ray into a direction parallel with the incident ray, as is the case when the surfaces of the glass are parallel; but they are bent. If a pure ray of white light from the sun be admitted into a dark room through such a prism, instead of being refracted altogether and appearing still as a white ray, it is divided into several rays of very vivid colours. In this state it is said to be analyzed, or decomposed into its elementary rays. Seven distinct colours can be distinguished—namely, red, orange, yellow, green, blue, indigo, and violet. The red ray is the least bent, and the violet the most. If these coloured rays be again collected by refraction through a convex lens, or by reflection from a concave mirror, they reproduce white light at the respective foci. The space illuminated and coloured by a pencil of rays from the sun thus analyzed is called the solar spectrum. (*See* SPECTRUM, SOLAR.) This analysis of white light, however, is not wholly dependent upon the refractive power of a transparent medium, but from an effect called *dispersion*. The mean refractive and dispersive powers of bodies are not proportional to each other. If a hollow glass prism be filled with oil of cassia, the spectrum produced will be two or three times longer than that of a solid glass prism. Different substances not only exhibit a difference of dispersive power generally upon all the rays of light, but are found to act unequally on the different rays. Thin plates or scales of different substances, or substances divided by fine regular lines, or consisting of minute fibres, have also the property of decomposing light which falls upon them; but the phenonema which they present are totally different, and depend upon different principles. The simplest case of this property occurs when a beam of divergent light enters a dark room by an aperture not more than $\frac{1}{40}$th part of an inch in diameter, and a thin rod, such as a pin, is placed in its course. On examining the shadow, fringes of coloured light will be found on both sides. (*See* DIFFRACTION OF THE RAYS OF LIGHT.) These fringes are caused by the *interference* of the rays bent into the shadow on one side of the body with the rays bent into the shadow on the other. Interference is accounted for by the undulatory hypothesis; and the alternate cessation and increase of sound produced by two musical notes nearly in unison, known by the name of *beats*, presents a marked analogy with the alternate luminous and black fringes arising from the interference of light. Thin plates of different substances, such as mica, produce similar phenomena of colour; and the same effects are seen in the splendid colours exhibited in soap bubbles, and also when a small quantity of oil is poured on the surface of water. The iridescent tints in mother-of-pearl, the varied plumage of many birds, and the colour of many shells and fishes, all depend upon the same cause. The law of refraction is far from general. Rays of light, in traversing the larger number of crystallized bodies, are commonly split into two pencils: one of these, called the *ordinary ray*, follows the common laws of refraction; whilst the other, called the *extraordinary ray*, obeys very different laws. This phenomenon is observed in all crystallized bodies which do not belong to the tessular system, or that class which may be supposed to be constructed of spherical particles, such as the regular cube, octohedron, &c. According to the nature of the crystal, and the direction in which it is cut, the division of the beam is greater or less. The best exemplification of this mode of refraction is to be found in a substance called *Iceland spar*, the crystallized carbonate of lime. If a small illuminated object be looked at through a rhombohedron of this substance in certain positions, two images of the object will appear; and on turning the crystal round in its own plane, so as to make a complete revolution, the two images will assume a regular movement with regard to each other, and one will fall upon the other, or coincide with it, twice in the revolution. If the rays of light separated by passing through Iceland spar be passed through another crystal placed similarly to the first, no further subdivision of the light will take place. If, again, the crystals be so placed that the principal sections are at right angles, there will still be but two images; but the ordinary and extraordinary rays of the first will become reversed in the second: at all intermediate positions, however, there will be a subdivision of each ray, and, consequently, four images. Each ray has then suffered a physical change, which has been called *polarization*, a term which indicates, according to Dr. Whewell, "opposite properties in opposite directions, so exactly equal as to be capable of accurately neutralizing one another." Many crystallized minerals, when cut into parallel plates, are sufficiently transparent to allow of abundance of light to pass through them, which, in consequence, is found to be polarized. Through a well-polished plate of *tourmaline*, cut from a crystal of a brown colour, in a direction parallel to the axis of the prism, a candle may be seen as through a piece of coloured glass, and no change will be observed on turning it round. If another similar plate be interposed between the first plate and the eye, and made to revolve slowly in its own plane, the candle will appear and disappear alternately at every quarter revolution, passing through every degree of brightness, to total, or nearly total, evanescence, in each quadrant. If the rays separated by a crystal of Iceland spar be examined by means of a plate of tourmaline, it will be seen that the *ordinary* image is most intense when the axis of the tourmaline is perpendicular to the principal section of the rhombohedron, and that it becomes extinct in the opposite direction. When the axis of the tourmaline lies in the principal section itself, the *extraordinary* image presents similar phenomena. The polarization of a ray of light may also be effected by reflexion. When a ray of light falls upon a polished glass surface at an angle of 56° 45′, if the reflected ray be examined through a plate of tourmaline, it will exhibit the same series of phenomena as if it had passed through another plate of the same substance. The light is invisible when the axis of the tourmaline is parallel to the plane of reflexion. Different substances polarize light by reflexion at different angles: water at 53° 11′, and the diamond at 68° 1′. The most interesting as well as the most splendid phenomena of polarized light are the brilliant and gorgeous colours which, under certain conditions, are developed by crystallized plates. If a ray of light which has been polarized be made to traverse a thin plate of mica, or sulphate of lime, which is colourless to common light, and then examined through a plate of tourmaline in that position where, without the plate, it would disappear, the ray will be seen, but splendidly coloured with tints depending upon the thickness of the plate and its inclination. The polarization of light has been made useful in detecting the nature of substances which elude the direct process of chemical examination, and also for the purpose of detecting rocks and shoals at the bottom of the sea. By viewing objects at the bottom of the sea through a polarizing tube, nearly the whole of the glare of the reflected light is extinguished.

LIGHT, CHEMICAL ACTION OF.—For many years it has been known that solar light is capable of producing powerful chemical changes. One of the most striking of these is its power of darkening the chloride of silver. This effect takes place slowly in diffused light, but very rapidly in the direct rays of the sun. It was at first thought that this effect was caused by the luminous rays; but through later observations it appears that solar light may be divided into three parts—the light-giving rays, the heat-giving rays, and the chemical rays. It is by the latter rays that the salts of silver are decomposed. The greatest chemical action, it has been observed, takes place just beyond the violet rays of the spectrum, and the property gradually diminishes till the green division is reached; beyond which it does not exist. (*See* PHOTOGRAPHY.)

LIGHT AND LIFE.—Light is of great importance in the vegetable kingdom; when deprived of it plants grow white, and contain an excess of aqueous and saccharine particles. To the influence of the sun's rays flowers owe all the variety, beauty, and intensity of their colours; and to man and all the superior animals the light of the sun is necessary for life, health, and strength. Recent observation demonstrates that the action of electric light upon plants resembles that of the light of the sun. In this respect electric light differs from, and is contrary to, all artificial lights. The presence of gas light, and the effect of its combustion, is fatal to the health of plants exposed to it; and artificial lights in general, though they may do no harm, do no good as electric light does.

LIGHT, ABERRATION OF.—(*See* ABERRATION.)

LIGHTNING, *lite'-ning* (Ang.-Sax.)—A sudden discharge of electricity from one cloud to another, or from a cloud to the earth, or from the earth to a cloud, producing a vivid flash of light, accompanied generally by a loud report called thunder. When a thunderstorm commences, light clouds with jagged edges are observed, the motions of which are often opposite and variable. At the surface of the earth, the atmosphere is still and calm, with a slight elevation of temperature and considerable barometric and hygrometric changes; producing sensations of closeness, faintness, and oppression. Low murmurings of distant thunder are then heard, after which the lower region of the air is refreshed by cooler, but light, breezes of uncertain direction. The thunder-clouds appear nearer, larger, and blacker, and the sensations of uneasiness increase. At short intervals, flashes of lightning are observed. Their course is sometimes zigzag, when it is called *forked lightning;* the breaking up of its course shows that it is dangerous, since the lightning must be near terrestrial objects. After the discharge, heavy showers of hail or rain descend, and the atmosphere is again cooled. The blackness then becomes universal, and the thunder is heard in a loud burst, almost instantaneously with the brilliant flash of lightning. The colour of lightning varies, being generally a changeable yellow, and sometimes red, blue, or violet, according to the density of the atmosphere. The identity of lightning with the discharge of ordinary electricity was discovered by Benjamin Franklin in America, and Romas in France. Franklin, in June, 1752, having perceived a thunder-cloud approaching, sent up a silk kite attached to a dry hempen cord. Soon afterwards he noticed that the loose threads of the cord stood erect, and upon approaching his finger to the cord, he drew sparks. A little rain falling, the conducting power of the cord was increased, and the violence of the shocks received from the sparks warned him that it was dangerous to continue the experiment. The experiments were repeated in Europe, and atmospheric electricity became a favourite study, till it was checked by the death of Professor Richmann, of St. Petersburg. He had attached a simple species of electrometer to his apparatus for measuring the intensity of the electricity in a thunder-cloud. After a loud clap of thunder, he proceeded to read off the degree indicated by his instrument, when a globe of electric fire was discharged through his body, and killed him on the spot. The causes which produce atmospheric electricity are not well known. In general, when a flash of lightning occurs, the earth and the cloud may be looked upon as the terminal planes of a highly-charged system of di-electric air, the tension of which goes on increasing until any further increase causes it to give way, when the opposite electricities rush together with violence, producing equilibrium by disruptive discharge, or a flash of lightning. There are several varieties of lightning, known by different names. *Forked lightning*, the only kind probably that strikes terrestrial objects, frequently divides into two or more zigzag ribbons or lines of light. When forming a long, rippling line of light, it is called by the sailors *chain lightning*. *Sheet lightning* seems to be spread over an immense surface, and varies in colour, being often red, but sometimes blue and violet. When lightning of this kind appears without thunder, it is called *summer lightning*, and is generally considered to be the reflection of some very far-distant storm. *Globular lightning* appears like a luminous ball or globe of fire, and travels comparatively slowly, while those mentioned previously are almost instantaneous. This variety of lightning, in a milder form, is known to the French and Spaniards as St. Elmo's fire; to the Italians as the fires of St. Peter and St. Nicholas; and to the Portuguese as corpos santos, which has been corrupted by English sailors into *comazants*. In this form it appears as tufts of fire on the top of ships' masts, the tips of bayonets, on the alpenstocks of Alpine travellers, or on the tips of the outspread fingers, when the atmosphere is in a peculiar state of electrical excitement.

LIGHTNING, PHYSICAL EFFECTS OF.—When lightning strikes the earth, it has generally been remarked that the flash is succeeded by suffocating odour, often compared to that of burning sulphur. To others, the odour appears to resemble that of phosphorus or nitrous acid. It seems probable that the smell is in reality due to the presence of ozone, generated by the action of the electric fluid on the air. One of the commonest effects of lightning is the fusion of metals. There is an instance on record of an iron chain being converted into a solid rod by the passage through its length of a flash of lightning. It has also been known to fuse sand and other silicious minerals into a kind of glass or enamel. When solid imperfect conductors are struck by lightning, they are torn and scattered to pieces. The masts of ships have in this way been shattered to fragments in an instant.

LIGHTNING, VITAL EFFECTS OF. —Lightning is very fatal to human life. Between 1835 and 1852, no less than 1,308 persons were killed by lightning in France. In all cases, accidents from lightning are more frequent in elevated situations than in the plains, and in villages in the open country than in populous cities. The best place for timid persons, who may be in a house unprotected by a lightning conductor, is the middle of the room, and at a distance from all walls, and especially from the fire and chimney. The effects of lightning upon living creatures are matters for interesting and valuable observation. They are the same in kind, and only differ in degree from artificially-produced electricity. A shock from a Leyden jar will kill a small animal, and local injury may be produced in like manner upon large animals. It sometimes happens, when death results from lightning, that there is no external evidence of injury; it is believed that in such cases death results from shock to the nervous system, communicated to the brain, and this is sometimes accompanied by indications similar to those observed in simple concussion of the brain. Such a shock may be followed by insensibility, accompanied by scarcely perceptible breathing and very weak pulse, dilated pupils of the eyes being usually one of the symptoms. These visitations are sometimes followed by death, but recovery is common, which may be complete or accompanied by distressing symptoms involving more or less prostration or helplessness of the system. The brain is often enfeebled, including loss of memory. Mania of greater or less violence and delirium are consequences to be feared. In some cases, however, the effect of the lightning flash is far different. When the current enters and leaves the body, wounds are sometimes made as with some blunt weapon. It is not uncommon for a bone to be broken, and ruptures of the membranes and viscera are likely. In other cases the parts affected seem as though scorched in a manner resembling the branches of trees, from which a vulgar superstition has arisen that the image of the tree struck has been communicated to the sufferer by some mysterious influence of a photographic character. When the sufferer has upon him any kind of metal, the flash sometimes takes a course accordingly. Watches, chains, keys, and other small metallic objects are apt to be injuriously attractive in this respect. The resulting concentration of shock from such causes often has the effect of setting the clothing on fire, or of tearing it in an extraordinary manner. Boots have been known to be burst, and as this has been especially remarked in cases of very strong boots, it seems probable that the attraction of the nails in the boots has led to that class of effects. In some cases the nails have been completely driven out of the boots. In some circles it was at one time believed that in persons who came to their death from lightning shock, the blood remained in a fluid state for a considerable time after death; but later investigations do not confirm such an impression, which seems to have been entertained on insufficient grounds. One of the exceptional effects of the shock has been to tear off the whole of the hair from the head and all the nails from the hands. Such terrible injuries usually inflict instant death, but where there is no great external symptoms, there may be hope of recovery. The object should be to keep up the breathing, and to promote circulation by friction of the limbs and application of warmth to the feet and hands. In some cases a cold bath has been apparently beneficial, but it seems to be of doubtful efficacy, and might result in fatal shock to exhausted energies.

LIGHTS, NORTHERN. (*See* AURORA BOREALIS.)

LIGNINE, *lig'-nine*,—An incrustation in the cellular tissue of wood, which imparts to it the springy hardness for which timber is distinguished from all other substances. It is insoluble in water, and in almost every fluid that is free from alkaline. It resembles cellulose, but differs from it in several respects. Its leading elements are carbon, hydrogen, and oxygen. Acetic acid can be distilled from it. As it is the essential principle of hardness in wood, the hardest trees contain the greatest quantity.

LIGNITE, *lig'-nite* (Lat., *lignum*, wood), fossil wood, more or less mineralized and converted into coal. The lignites are generally dark-brown, and woody in their structure. They are distinguished from true coal by burning with little flame and much smoke, owing to their containing a smaller proportion of carbon. The brown coal of Germany, which belongs to the tertiary formation, is much used as a source of paraffin and paraffin oils.

LIGNUM RHODIUM, *lig'-num ro'-de-um.* —A hard wood derived from *Amyris balsamifera*, a woody species of *Convolvulus*, formerly grown in the Levant, but now obtained from Jamaica, the Canary Islands, and America. The wood, in addition to its hardness, is remarkable for the odour of roses which is evolved from it when cut, though, when tasted, there is a predominance of bitter. An oil is obtainable from it, which is available for perfuming ointments, &c. It is also frequently substituted for otto of roses, which is hence liable to be much adulterated.

LIGNUM VITÆ, *vi'-te* (*see* also GUAIACUM), is an extremely hard and correspondingly tough wood grown in the West Indies and elsewhere. The hardness and toughness is owing to the peculiar interlacing of the fibres, unknown in any other wood. Eighteen inches is the utmost diameter, and the centre or heart of the tree is the best. It is surprisingly heavy, and of a dark-greenish colour. The value of it is very great for pulleys, ships' blocks, bowls, and other purposes, where hardness, strength, and durability are important. It has still other virtues. The waste of the wood and the bark yield a resin which possesses medicinal qualities, in much estimation in cases of syphilis and rheumatism.

LIGULATE, *lig'-u-late* (from *ligula*, a little tongue), is a name given in Botany to a corollar with one petal, split on one side, and disposed like a toothed tongue. It may be familiarly observed in the dandelion, aster, and daisy.

LIGULE. (*See* GRAMINACEÆ.)

LILAC, *li'-lak*.—This flowering shrub, so familiar to our gardens, is common throughout Europe and North America, though derived from the north of Persia. The wood, when well grown, is available for many small purposes where hardness and fine grain are required. Perfume is distilled from the flowers and a bitter tonic from the capsules. The blossoms are called "conical panicles." They are of the well-known lilac colour or white. In addition to the common lilac thus described, there are occasionally seen Chinese and Persian lilac trees. The former is known by larger flowers with less odour, the latter by its narrower leaves. (*See* also SYRINGA.)

LILIACEÆ, *lil-e-ai'-se-e* (Lat., *lilium*, the lily).—In Botany, the Lily family, a natural order of *Monocotyledones*, sub-class *Petaloideæ*. Herbs, shrubs, or trees, with bulbs, rhizomes, tuberous or fibrous roots, and parallel-veined, sessile, or sheating leaves. Flowers regular; perianth green or petuloid, inferior, 6-leaved, or 6-parted; stamens 6, inserted in the perianth or rarely into the thalamus; anthers introrse; ovary superior, 3-celled; style 1; stigma simple, or 3-lobed. Fruit a loculicidal capsule, or succulent and indehiscent, 3-celled. Seeds with fleshy albumen, numerous. The *Liliaceæ* are widely distributed throughout the temperate, warm, and tropical regions of the globe. There are 147 genera, and about 1,200 species. Among the useful plants of this order are the onion, leek, asparagus, squill, and aloe; and among the valuable products yielded by them are fibres, used for twine and cordage, edible seeds, and balsamic resins.

LILIUM, *lil'-e-um* (Lat.)—In Botany, the Lily, the typical genus of the natural order, *Liliaceæ*. *L. candidum*, the white lily, has always been considered the emblem of purity; and this and many other species form beautiful border flowers. *L. martagon* and its varieties are known as Turk's-cap lilies, from the turban-like form of their flowers. The bulbs of some species, as those of *L. tenuifolium kamschaticum* and *spectabile*, are commonly eaten in Siberia.

LILY OF THE VALLEY.—A genus of plants (*Convallaria*), of the natural order *Liliaceæ*. The common Lily of the Valley, *C. majalis*, is called the May-flower in Germany, and is well known in this country for its beauty and perfume, which is a decided narcotic. *Eau d'or* is the French name of the distillation from the flowers. The flowers, as well as the berries and root, have a disagreeable, bitter taste, with purgative properties.

LIMA WOOD, *li'-ma*.—The heart wood of *Cæsalpinia echinata*. (*See Cæsalpiniæ*.) It produces red and peach-coloured dye.

LIMB.—In Astronomy, the name given to the border or edge of the disc of the moon or any planet, and also further applied to the edges of circles that form part of any astronomical instrument. The term is used more particularly in reference to the moon in descriptions of lunar eclipses.

LIME, (Fr., *lime*), the fruit of *Citrus limetta*. —It is imported into this country in a preserved state for use as a dessert. Its juice is also largely imported for the preparation of citric acid, and for the prevention of scurvy on board ship. (*See* CITRUS.)

LIMESTONE.—A general term applied to a great variety of rocks which contain a certain quantity of lime. Chalk is an earthy, massive, opaque variety, generally soft, and without lustre. (*See* CHALK.) In nature, carbonate of lime is found more or less pure, both perfectly crystallized, as in calc-spar and arragonite; imperfectly, as in granular limestone; and in compact masses, as in common limestone, chalk, &c. Concretionary limestone, generally called stalactitic carbonate of lime, is formed by the filtration of water through rocks containing lime, which is dissolved out; and as the water drips slowly out in cavernous recesses, it parts with its carbonate of lime, which is deposited in zones, more or less undulated, which have a fibrous structure. These fibres are very beautifully shown in the long, fibrous pieces called stalactites. The stratified variety called stalagmites shows a similar structure, varied only by the circumstances under which it was produced. *Incrusting concretionary limestone* is similar to the above. It is found in calcareous springs, which are common in Derbyshire, Yorkshire, and other places. It is a common practice to place vegetable substances in these springs, when they become encrusted with carbonate of lime, and present all the appearance of fossils. There are several remarkable wells of this kind in volcanic districts, in some of which the water flows in almost a boiling state. *Spongy limestone* is found at the bottom of those lakes the water of which is impregnated with lime. *Travertino*, a limestone deposited by the waters of the Anio and the Solfaterra of Tivoli. Most of the monuments in ancient Rome were constructed of it. *Compact limestone* has a close texture, usually an even surface of fracture, and dull shades of colour. *Granular limestone* includes statuary and architectural marble, and has a texture somewhat resembling that of loaf-sugar. (*See* MARBLE.) *Oolite* consists of rounded particles of limestone like the roe or eggs of a fish. Coarse lias is sometimes called *coarse grained limestone*. *Marly limestone* is found in lake and fresh-water formations; its texture is fine-grained, its colour white or pale yellow, and it is apt to crumble in the air. *Silicious limestone* is a combination of silica and carbonate of lime; and *Stinkstone* is a carbonate of lime combined with sulphur and organic matter, which emits the smell of sulphuretted hydrogen when struck or rubbed. It is found in Derbyshire, Sutherlandshire, and some parts of Ireland. All limestones seem to have been the result of deposition effected by chemical changes. The vast space of time required to accumulate the great limestone ranges of this country cannot be estimated. (*See* LIME.)

LIME TREE, OR LINDEN, introduced in the 16th century, is now common in England. The trees in St. James' Park are notable examples. The wood is light and soft, but possesses toughness and durability, being much resorted to for carvings. The charcoal made from it is very superior, and is recommended for tooth-powder, crayons, and gunpowder. The fibres of the bark are available instead of hemp for ropes, &c. The flowers have a peculiar odour, sometimes very pervading in the evening, while bees find abundance of honey in them during the day. (*See* TILIA.)

LIMITS, OR LIMIT, is a theory in Mathematics. It may be illustrated by the following instance: $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16}$ successively brings the sum nearer and nearer to 2, with the curious circumstance that the difference between the sum and 2 is always the same as the last fraction named. The extent of the difference may be extended by fractions until the difference becomes less than the last fraction named. Further illustrations of the principle, and the uses of knowledge concerning it, are dealt with in Newton's *Principia* and in other exhaustive treatises on mathematics.

LIMIT OF AUDIBLE NOTES.—In Music, the lower limit to the sequence of similar sounds, which produce a musical note, is about 16 complete vibrations in a second. At lower rates of sequence the ear can distinguish the separate sounds. The higher limit varies with different individuals. 3,600 vibrations per second give the highest audible note, whose vibrations have been numbered. 24,000 is the limit of most ears. As the chirp of crickets and the squeal of bats consist of a great number of vibrations, the noise which these creatures make is unheard by many.

LIMNANTHACEÆ, *lim-nan-thai'-se-e* (Gr., *limne*, a marsh; *anthos*, a flower).—In Botany, a small natural order of *Dicotyledones*, sub-class *Thalamifloræ*, included by Lindley in the *Tropæolaceæ*, with which it agrees in general characters. It is, however, distinguished from that order by having regular flowers, more evidently perigynous stamens, and erect ovules. There are but two genera and three species, natives of North America.

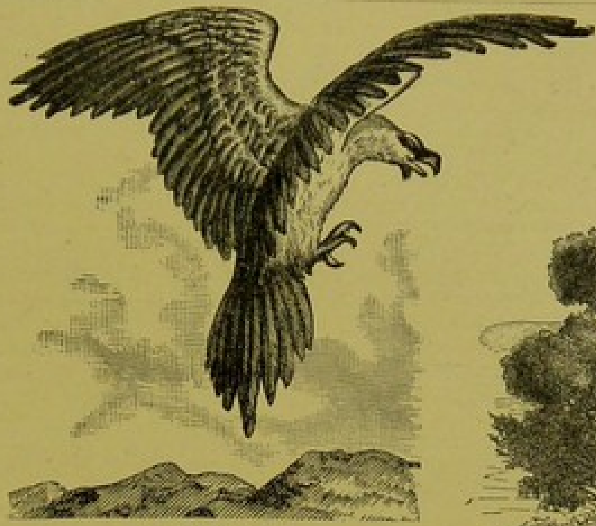
LIMNÆA, *lim'-ne-a*.—A genus of gasteropodous molluscs, order *Pulmonata*. The species are numerous, abounding all over the world wherever their natural habitat exists, that is, in fresh water swamps. The shell is horn-coloured, thin, and delicate, varying somewhat in configuration from the elongated spiral to the coiled spiral. They feed upon vegetation, especially upon algæ and decaying matter, in seeking for which many of them float, shell downwards, and glide about the surface of the water, their motions in a fresh-water aquarium being very remarkable, and their results being the prevention of redundant growth in the water plants and the removal of exhausted portions. They are remarkable examples of Hermaphroditism, and deposit their eggs on any aquatic plant or convenient stone within the limits of their resorts. They cover their eggs with a glazy substance which has the effect of fixing them and preserving them from excessive influence of either water or air. The development of the eggs can be readily observed with remarkable facility, as they are perfectly transparent; indeed, these eggs and the creatures produced from them afford great scope for interesting investigations. In nature, the eggs and the climnæ, in every stage of their existence, afford food for fishes, and a very large proportion of them are hence devoured.

LIMNORIA, *lim-no-re'-a*.—A genus of crustacea of which there is but one ascertained species, well known from the mischief resulting from their depredations. The creature resembles a wood-louse, but averages much smaller, being generally a sixth of an inch long. It may be known by its ash-grey colour, short legs, broad head, and black eyes made up of *ocelli*. Its habitat is timber wherever in contact with sea water, and upon this timber it feeds, committing, in the aggregate, most destructive ravages. In the course of its feeding it perforates and weakens all the wood-work with which it comes in contact, and so destroys piers, dock-gates, and other important works and structures, for which it appears there is no certain defence. Sometimes, when the season is peculiarly favourable, the depradations are more than usually rapid, so as to weaken and render dangerous temporary structures. This occurred in a remarkable manner with the woodwork in use during the building of the Bell Rock lighthouse. Serious evils have also been experienced at Southampton. There seems to be no absolute immunity attainable, but kyanising of the wood is believed to mitigate and possibly to prevent such mischief in some cases.

LIMPET, *lim-pet*.—An interesting genus of the *Cyclobranchiata* order of gasteropodous molluscs, in the family of *Patellidæ*, in which the shell is distinctly not spiral but conical, having a wide mouth and the apex turned forwards. The creature is remarkable in having one comparatively large foot of great muscular power, which has the property of creating an adhering vacuum to which is added a viscous secretion. By these combined means limpets are enabled to adhere to a rock so firmly that it is often impossible to remove one without breaking the shell. Having this extraordinary power, their habitat is limited to the surfaces of rocks not lower than low water nor higher than high water on the coasts. When the tide is out they remain in an apparent state of torpor, being compelled to remain motionless, or nearly so, on account of the necessity for keeping their gills excluded from the air with which they cannot bear contact. At high tide a proportion of these become disengaged and move about in the water; but this does not occur every tide, and some individuals are believed to remain almost perpetually fixed to the same spot, as soft rocks are found indented to their exact form. They feed during high water upon algæ, which they seize with a remarkable tongue, having teeth sometimes extending to 160 rows of 12 teeth each, making 1,920 teeth in all. Limpets are available for human food, but are chiefly resorted to for bait. Those of Britain have no other value, but some of those found on the coasts of South America have each a beautiful shell, a foot wide, and available as a basin. This occurs more or less in all hot climates.

LINACEÆ, *lin-ai'-se-e* (Lat., *linum*, linen).—In Botany, the Flax family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*, having the following essential characters:—Herbs, or very rarely shrubs, with exstipulate, simple, entire leaves. Flowers hypogynous, regular, and symmetrical; sepals, petals, and stamens 3, 4, 5 each; the sepals persistent and imbricate; the petals deciduous and twisted in æstivation; the stamens united at their base, and having little tooth-like abortive stamens alternating with them; ovary 3, 4, 5-celled, styles distinct; stigmas capitate. Fruit capsular, many-celled, each cell more or less divided by a spurious dissepiment, and each division containing one seed. Seeds with little or no albumen, and having a straight embryo. The *Linaceæ* are chiefly natives of the south of Europe and north of Africa. There are four genera and ninety species. They are generally remarkable for the tenacity of their

LINNET.



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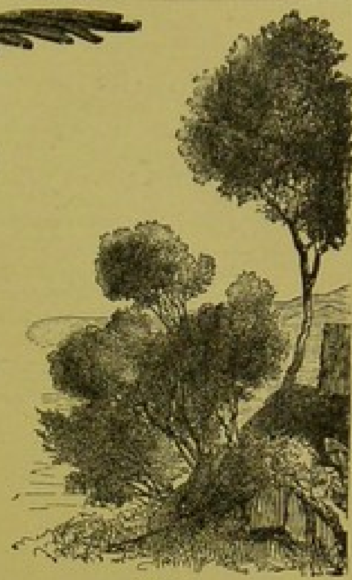

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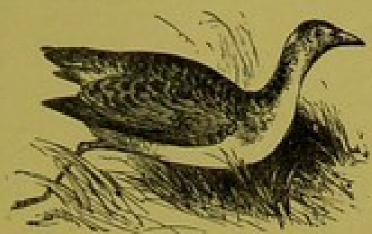

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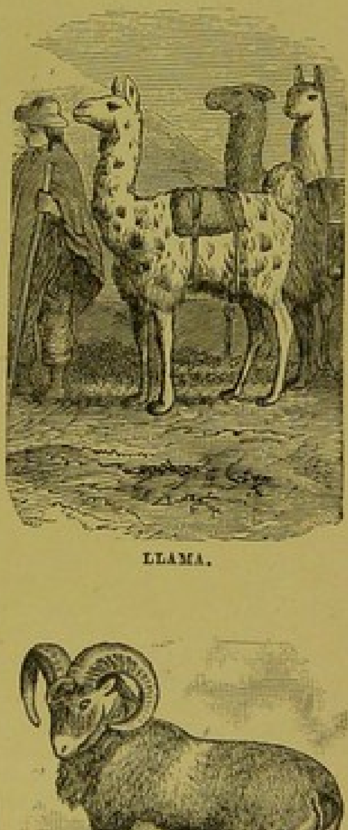
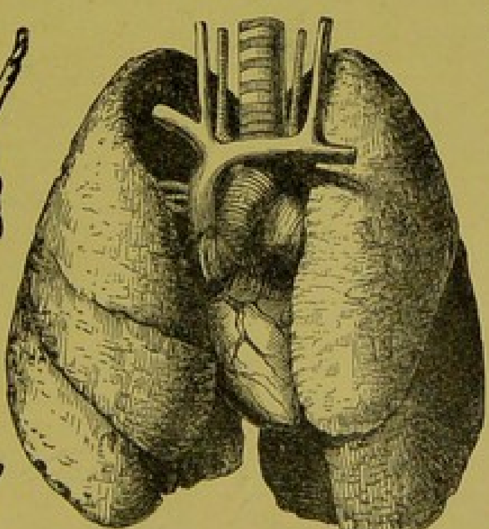


LLAMA.

LAMINARIA FASCIA, (SEAWEED).

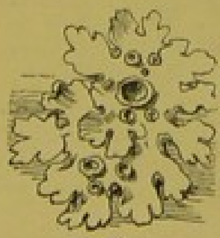


LUNGS AND HEART.

MOUFFLON.

LABIATE.

LEMON.



LICHEN.

LARVA, OR CATERPILLAR.

liber fibres, and also for the mucilage and oil contained in their seeds. (*See* LINUM.)

LINDEN-TREE. (*See* LIME-TREE.)

LINE, in Mathematics. (*See* GEOMETRY.)

LINE OF ELECTRIC FORCE.—In an electric field, or field under the influence of a given distribution of electrified bodies, lines of force, that is, lines in the direction of whose tangent at each point is that of the resultant force at that point, may be drawn upon principles similar to those which are drawn in a magnetic field, and they possess properties analogous.

LINE OF MAGNETIC FORCE.—A line of magnetic force, or simply a line of force (magnetic being understood), is a line which is at each point parallel to the resultant of all the forces at that point. Faraday, who introduced it, called it "that line which is described by a very small magnetic needle, when it is so moved in either direction correspondent to its length, that the needle is constantly a tangent to the line of motion; or it is that line along which, if a transverse wire be moved in either direction, there is such a tendency; or it is that line which coincides with the magnecrystallic axis of a crystal of bismuth, which is carried in either direction along it." The arrangement of the lines of force about a magnet, or about a number of magnets whose different forces interfere with each other, may be approximately and very beautifully exhibited to the eye by covering them, when laid on a table, with a tightly-stretched screen of white paper, and then scattering fine iron filings over the paper with a sieve. The filings arrange themselves in curves, which radiate from the poles of the magnet in directions depending on the form of the magnet, and, if there be any magnetic matter in the field, on the position of it with respect to the magnet. In the case of a straight bar magnet, evenly magnetised, they start from the poles, and turn inward to meet each other, bending round in oval curves. Faraday pointed out another experimental way of recognising and examining the lines of force, both in direction and intensity—namely, by means of a conducting wire moved across them.

LING, *ling* (Dutch, *leng*), (*Lota molva*), a well-known and valuable fish, belonging to the family of the *Gadidæ* (Codfish family). In addition to the generic character of the *Gadidæ*, which will be found given under the article HAKE, it possesses the following especial one—namely, that it has a chin with one or two barbules upon it. The body of the ling is a little more elongated than the hake, being usually from three to four feet long. The back and sides are of a grey colour, somewhat inclining to olive, although occasionally cinereous; the under portion of the body silvery; ventrals white; dorsal and anal fins edged with white; and, lastly, the caudal, marked near the end with a transverse black bar, the extreme tip, like the other fins, being white. The ling is naturally an inhabitant of the northern seas, like the rest of its family. Great quantities of them are taken round the Western Islands, in the Orkneys, and on the Yorkshire and Cornish coasts.

LING.—The name given by the Chinese to the plant termed *Trapa bicornis*, which produces edible seeds, said to be very delicious.

LINNÆAN SYSTEM, *lin'-ne-an.*—In Botany, the order or methodical arrangement of plants adopted by Linnæus, the Swedish naturalist, early in the 18th century. This system had the most surprising success, on account of its extreme simplicity, and the singular facility which it affords for attaining a knowledge of the names of plants. Up to that time each species was named by a characteristic phrase, in which the distinctive characters were frequently not included. These phrases were so long that it was very difficult to retain any number of them in the mind. By the Linnæan system, a proper or generic name was given to each group or genus; and each species of these genera was designated by a specific name added to the generic. By this ingenious contrivance, the study of botany, then very extensive, was quickly simplified. (*See* BOTANY.)

LINNET, *lin'-net* (Fr., *linot;* Sax., *linetwege*).—A bird belonging to the family *Fringillidæ*, order *Incessores*, division *Corvirostres*. Its characteristics have been described under the article FRINGILLIDÆ, and therefore they need not be here alluded to. The common linnet (*Linota cannabina*) is well known in England, where it is sometimes also called the brown linnet, or rose linnet. The male of this bird, in summer, has the beak of a bluish lead-colour, the irides hazel; the feathers of the fore part and top of the head greyish-brown at the base, but vermilion-red at the top; round the eye, the ear-coverts, and back of the neck, greyish-brown; the whole of the back, wings, and upper tail-coverts, uniformly of a rich chestnut-brown; the quill-feathers are nearly black, with narrow outer margins of white; tail-feathers black, with narrow outer edges, and broad inner ones of white; the chin and throat are coloured with a mixture of brown and grey; the breast is vermilion-red, with a few pale-brown feathers intermixed; the flanks and remainder of the bird are in general brown, including the legs, toes, and claws. In winter and autumn the linnet has no red colour on the head or breast, and the plumage is altogether of a more dusky hue than in summer. The female bird is a little smaller than the male, and the colour of its plumage is much lighter also. The *Mountain Linnet* is distinguished from the common linnet by the greater length of its tail, which gives the bird a more elongated and slender appearance. It is also still further distinguished by the colour of the feathers on its head, which are of a tawny reddish colour, in lieu of the vermilion-red of the common type. This bird is a winter visitor to the southern parts of England; but it often breeds both in the north of England and Scotland.

LINSEED. (*See* LINUM.)

LINUM, *li'-num* (Lat.)—In Botany, the most important genus of the natural order *Linaceæ*. The libre-fibres of *L. usitatissimum*, when prepared in a certain way, constitute *flax*, of which linen fabrics are made. Linen, when scraped, forms *lint*, which is so much used for surgical dressings. The short fibres of flax which are separated in the course of its preparation constitute *tow*. The seeds of the flax-plant are called *linseed*. The seed-coat contains much mucilage, and the nucleus of the seed oil. The oil may be readily obtained from the seeds by pressure; the amount depends on the method adopted, and varies from 18 to 27 per cent.

Linseed-oil is especially remarkable for drying rapidly when applied to the surface of any body exposed to the air, and thus forming a hard, transparent varnish. This property of drying quickly is much developed by previously boiling the oil, either alone or with some preparation of lead. The cake left after the expression of the oil is known as *oil-cake*, and is much used as a food for cattle. When powdered, it is commonly sold as *linseed-meal*, which is much used for making poultices and for other purposes. The linseed-meal, however, as directed to be used in the London Pharmacopœia, is merely linseed powdered; hence it contains the oil, which is not present in ordinary meal.

LION, *li'-on* (Fr., from Lat., *leo, leonis*).—This animal, erroneously described by the ancients as the king of beasts, belongs to the family of the *Felidæ*, a genus of the class *Mammalia*, order *Fera* (rapacious beast), of which family the lion is the type. In walking, only the soft parts of the feet touch the ground; hence the tread is noiseless. The lion glides along with a stealthy pace until it crouches within proper distance, when it springs with fearful velocity and force upon its unsuspecting prey. Another adjunct of terror with regard to this animal is the fearful roar which it emits at the moment it pounces on its prey: its unhappy victim being deadened, as it were, with fright at the same moment as it feels its enemy's talons and murderous teeth. The other generic characteristics of the animal will be found given under the article FELIDÆ. Formerly only one species of the lion was admitted by zoologists; but of late, as discovery has opened fresh fields for investigation, it would appear that there are several degrees and varieties of this animal. Of all the different varieties which have been observed by naturalists, the African lion *(Leo Africanus)* is by far the finest, most powerful, and the most ferocious; but Dr. Livingstone has placed it upon record that these ideas very much exaggerate the supposed nobility and respect due to the lion. The lion has been hailed by the title of "king of beasts" and "monarch of the forests," and has been considered as the emblem of majesty and might. It is the symbol of the British nation, and is borne on the royal arms. But all the poetic imagery with which it has been surrounded is altogether unlike its real nature, which is characterized by its overwhelming its prey merely by surprise in attack, and its running away generally at the slightest display of resistance from man—sometimes even the sight of man is sufficient to cause the "king of beasts" to take to degrading flight.

LIP, *lip* (Sax., *lippa;* Lat., *labium*).—In Anatomy, constitutes the outer edge or border of the mouth. The lips are formed by muscular fibres, glands, and cellular tissue, covered by mucous membrane. They owe their extremely red colour to the thinness of the covering membrane, and their sensitiveness to an abundant supply of minute nervous fibres. They are not unfrequently affected with cancer. (*See* CANCER.) The lips form part of the organs of speech, and are necessary to the pronunciation of certain letters, which are hence called labials or lip letters.

LIPOMA, *li-po'-ma* (Gr., *lipos*, fat).—In Surgery, is a soft, indolent tumour, arising from a luxuriancy of fat in the cellular membrane.

LIPPITUDO, *lip-pe-tu'-do* (Lat., *lippus*, blear-eyed), is a chronic, inflammatory disease of the eyes, commonly called bleared-eyes. It consists in the exudation of a puriform humour from the margins of the eyelids, which often causes them to stick together during the night. (*See* OPHTHALMIA.)

LIPYL, OXIDE OF, *lip'-ile.*—In Chemistry, C_3H_2O, a hypothetical body, supposed by Berzelius to form the base of oils and fats, and to unite with two equivalents of water to form glycerine at the moment of decomposition.

LIQUID, *lik'-wid* (Lat., *liquo*, I melt).—A fluid; a material substance the particles of which have a perfect freedom of motion, without any sensible tendency to approach to or recede from one another, except by the action of some external power. Liquidity, as a condition of matter, is therefore comprehended in the condition of fluidity. (*See* FLUID.) The particles of a liquid are held together with considerable force, notwithstanding their freedom of motion, since a small quantity of a liquid has a tendency to take a spherical form when at a distance from any substance for which its particles have greater affinity than for one another. This is particularly apparent in mercury, oil, and water. The first of these, upon being allowed to drop on a table, separates itself into globules; and the two others take a similar form when a small quantity of either is suspended from the extremity of a pointed object. The form of the dewdrop is also another familiar instance.

LIQUIDAMBAR, *lik'-wid-am-bar.*—In Botany, a genus of balsamiferous trees, constituting the natural order *Altingiaceæ*, or *Balsamifluæ*. There are three species, which are natives of the warmer parts of India, North America, and the Levant. *L. orientale* yields the *liquid storax* of the shops: this is obtained from the inner bark, which is afterwards used by the Turks for the purpose of fumigation, and is the *cortex thymiamatis* or *storax bark* of pharmacologists. In Cyprus the tree is called *xylon effendi* (the wood of our Lord). *L. styraciflua*, an American tree, yields by incision a fluid balsamic juice, called *liquidambar*, or *copalm balsam*. *L. altingia*, a native of Java, yields a similar fragrant balsam. In their effects and uses these products resemble the balsams of Peru and Tolu, benzoin, &c.

LIQUIDS, *lik'-widz* (Lat., *liqueo*, I flow).—In Grammar, is a term applied to the four letters *l, m, n, r*, from their readily uniting with other consonants, and flowing, as it were, into their sounds. They are also called semi-vowels.

LIQUIFACTION AND SOLIDIFICATION OF GASES.—Gases and vapours were formerly held to be distinct in their nature, but Faraday showed that a large proportion of gases can be liquified, and liquids converted into gases. The gases that will not liquify are oxygen, hydrogen, nitrogen, carbonic oxide, nitric oxide, and marsh gas.

LIQUORICE, *lik'-o-reece*, commonly known in a solidified form, is juice derived from the roots of the *Glycyrrhiza*, a genus of the order of *Leguminoseæ*, called Sweet Root. It is a native of the south of Europe and Asia. It will grow in the south of England, but is most cultivated with success in Spain, whence our supplies are mainly derived. The juice owes its properties to a substance named Glycyrrhizine, having a relationship to sugar. It is yellow, transparent, will not crystallize, is soluble in either alcohol or water. It was known by the ancients, and still retains its place as a well-recognized emollient and demulcent, having a high reputation as a mitigation of common cold, its action being upon the mucous membrane.

LIRIODENDRON. (*See* TULIP TREE.)

LITCHI. (*See* NEPHELIUM.)

LITHIASIS, *lith-i'-a-sis* (Gr., *lithos*, a stone).—In Med., is the disease of stone in the bladder or kidney (*see* CALCULUS). Also a disease of the eyelids, in which their margins are beset with small, hard tumours.

LITHIC ACID. (*See* URIC ACID.)

LITHIC ACID DIATHESIS, *lith'-ik di-ath'-e'-sis.*—The state of a patient when suffering from excess of lithic acid in the urine.

LITHIUM, *lith'-e-um* (from *lithos*, a stone). —One of the alkaline group of metals, of which potassium, sodium, cæsium, and rubidium, are the other members. It closely resembles these metals in most of its properties, forming an alkali by its union with oxygen, decomposing water at ordinary temperatures, and having so low a specific gravity that it will float in the lightest known fluid. It is found in nature, in available quantities, in triphyline, petalite, and lepidolite; and from the experiments of Messrs. Bunsen and Kirchoff, it appears to be very widely distributed in minute quantities in mineral springs, soils, and the ashes of plants. The oxide lithia, LiO, forms a hydrate like potash and soda. It differs from them by being less soluble in water, by not deliquescing in air, and by acting on platinum at a high temperature. The salts of lithia are colourless. The *nitrate* is very soluble and deliquescent; the sulphate is soluble and forms fine crystals; the carbonate is sparingly soluble, giving an alkaline reaction. The chloride of lithium crystallizes in cubes, and is very deliquescent and soluble in alcohol, therein differing from the chlorides of potassium and sodium. The salts of lithia, when exposed on platinum wire to the inner blowpipe flame, colour the outer flame a brilliant red. It will be seen from the above brief description that lithia forms the connecting link between the alkalies and the alkaline earths. Lithia and its salts have remained without any practical value from the time of their discovery, in 1817, by Arfwedson, until a few years since, when Dr. Garrod introduced its use in cases of gout and stone. Its action on the uric concretions is much more rapid than that of the salts of potassium and sodium. It is generally exhibited in the form of aërated carbonate or effervescing citrate.

LITHOLOGY, *lith-ol'-o-je.* — In Geology, takes into account the structure and constitution of rocks without regard to their antecedents.

LITHOMARGE, OR MOUNTAIN MARROW, *lith'-o-marj.*—A mineral combination of silica alumina and oxide of iron, together with colouring matter of variable character. It abounds in the tin mines of Cornwall, and occurs in various parts of Europe. It is of a soft, greasy consistency, and has the property of adhering in a peculiar manner to the tongue when so tested.

LITHONTRIPTIC, *lith-on-trip'-tic* (Gr., *lithos*, a stone; and *tribo*, I wear away).—In Medicine, was a term used to denote certain medicines which were believed to have the power of dissolving calculi in the bladder. They were chiefly preparations of alkalies, which, by correcting the acid state of the urine, tended to alleviate the pain; but experience has abundantly proved that they possess no power of breaking up or dissolving the stone. The term is now generally applied to such medicines as are useful in counteracting the formation of calculi.

LITHOPHAGIDÆ, *lith-o-faj'-i-de* (Greek, stone-eaters), molluscs that burrow in the rocks for shelter.

LITHOTOMY, *li-thot'-o-me* (Gr., *lithos*, a stone; and *temno*, I cut).—In Surgery, is the operation of cutting into the bladder, in order to extract one or more stones or calculi from it. In the article CALCULUS we have already given an account of the nature and formation of these substances; and here we shall notice shortly the operation that is generally had recourse to in order to remove them. It is first of all necessary to ascertain the actual existence of the stone in the bladder, and that it is not encysted, or adherent to any portion of its substance. This is done by introducing a metallic instrument, called a *sound*, through the urethra into the bladder, by which the stone may be felt, and a sound produced by striking it. Several methods have been recommended of extracting the stone; but there are only two of them that can be adopted with any propriety: one of these is called the "high operation," from being performed immediately above the pubes. There are, however, several objections to this mode of operation, and it is now rarely adopted, except for some special reason, as where there is disease of the urethra. The other is called the "lateral operation," on account of the prostate gland and neck of the bladder being cut laterally. In this case the incisions are made in the perinæum, and the neck and lateral part of the bladder laid open, so as to allow of the extraction of the stone; it is to be removed by the finger if possible, and if not, by a forceps. Where large, it is sometimes necessary to crush the stone, and take it way piecemeal; in every instance the cavity of the bladder ought to be examined with the finger, to ascertain that there is no other stone present. Where numerous, they may be removed with a scoop; and if broken down, tepid water should be injected, so as to remove every portion of the calcareous matter, and prevent a nucleus remaining for the formation of a future stone. The after-treatment is simple: the wound is left open, or only covered with some simple ointment, and in a dependent position, that the urine may flow freely through it.

LITHOTRITY, *li-thot'-re-te* (Gr., *lithos*, a stone; and *teiro*, I break into pieces).—In Surgery, is the operation of breaking into pieces a calculus in the bladder by means of instruments passed into that organ through the urethra, so that the fragments may be discharged through the latter, and thus the performance of the operation of lithotomy rendered unnecessary. This is one of the great triumphs of modern surgery, and its introduction has taken place since the commencement of the present century. Various modes of performing the operation have been adopted, but the most approved is that of passing a pair of strong, sliding forceps, furnished with teeth, through the urethra into the bladder, and laying hold of the calculus, when the lower limb of the forceps is fixed in a vice, and the upper struck smartly with a hammer, so as to break the stone. The instrument is then withdrawn, and the fragments are afterwards voided with the urine. If portions remain, the operation is repeated from time to time. This operation is so simple, attended with so little danger, and productive of so little pain, as to render it, where it can be used, immeasurably preferable to lithotomy. When the calculi are very large or very hard, it cannot be adopted.

LITRE, *leet'-r.* (*See* METRIC SYSTEM.)

LIVER, *liv'-er* (Sax., *lifer*; Gr., *hepar*).—In Anatomy, is the secreting organ or gland by which the bile is formed. It is situated in the right hypochondriac and epigastric regions, below the diaphragm, and is of a reddish-brown colour. Its form is irregular, being convex on the upper surface, irregularly concave below, very thick behind, and very thin in front, and in the adult it generally weighs from three to four pounds. It is divided into two principal lobes, the right and left, the former of which is by much the larger. They are divided on the upper side by a broad ligament, and below by a considerable depression, or fossa. Between and below these two lobes is a smaller lobe, called lobulus Spigelii. To the left it has the fissure for the lodgment of the ductus venosus; on the right, the fissure for the vena cava. The lobulus candatus is a tail-like process of the liver, stretching downwards from the middle of the right lobe to the lobulous Spigelii. The liver, like the other viscera of the abdomen, receives an investment from the lining membrane of that cavity—the peritoneum, which, being reflected from it at different points, forms broad bands, connecting the liver with the surrounding parts. An investment of areolar tissue is also spread over the organ, extending into the interior, and forming thin but dense sheaths to the vessels and canals, called the capsule of Glisson. The blood-vessels of the liver are the hepatic artery and veins, and the vena portæ; the lymphatics are numerous, and the nerves are supplied from the pneumogastric and phrenic, and the hepatic flexus. The proper tissue of the liver is composed of a great number of granular bodies, of the size of millet, and called lobules, of a foliated appearance. The liver thus receives two kinds of blood—arterial, by means of the hepatic artery, in small quantity, destined principally for the nourishment of the gland; and venous, by the vena portæ, in much larger quantity, from which the bile is principally formed. The tributary branches, by the junction of which the main trunk of the portal vein is formed, comprise the veins which receive the blood from the stomach and intestinal canal, the spleen, pancreas, and gall-bladder. From these various sources venous blood is poured into the liver by the vena portæ, which divides and subdivides, like an artery, till it reaches the interlobular spaces, forming a freely anastomosing network throughout the organ, and constituting the interlobular veins. From these interlobular veins proceed, on every side, minute capillaries, which form dense networks, that seem to make up nearly the whole substance of the lobules. Through the capillaries the blood passes into intra-lobular veins, of which one, with its outspread branches, occupies the centre or axis of each lobule; and these intra-lobular veins, by successive junction and conflux, make up the trunks of the hepatic veins, by which the blood of the portal vein, after secreting the bile, is carried from the liver. The secretion of bile (*see* BILE), though the chief and most obvious of the functions of the liver, is not the only one which it has to perform; for recent discoveries have shown that important changes are effected in certain constituents of the blood, in its transit through this gland, whereby they are rendered more fit for their subsequent purposes in the animal economy. From the labours of M. C. Bernard, it appears that the low form of albuminous matter conveyed from the alimentary canal by the blood of the portal vein, requires to be submitted to the influence of the liver before it can be assimilated by the blood. The liver also possesses the remarkable property of forming sugar out of principles in the blood which contain no trace of saccharine or amylaceous matter. Recent investigations have disclosed that the blood, in passing through the liver, acquires a larger proportion of sugar. The association of the liver with sugar is also proved by the fact that though a newly-killed liver be thoroughly washed with water, sugar continues to increase in it for some hours after death. From this it is inferred that the liver is in some way a producer of sugar, the hepatic tissue being supposed to be the active agent in the production. It is also found that saliva, added to a decoction obtained from a newly-killed liver, will develop sugar not previously present in the decoction. From this it is supposed that the decoction must be some form of starch, and the process disclosed accounts for the production of heat by the liver. The excretory apparatus of the liver consists of the hepatic, common, and cystic ducts, and the gall-bladder. The biliary ducts commence by small twigs in each lobule, and join, forming, where they emerge from the gland, the hepatic duct. This duct, after passing down for a short distance, is joined at an angle by the cystic duct from the gall-bladder. The common duct thus formed is called the ductus communis coledochus, and empties itself into the duodenum. The retention of the materials of the bile in the blood acts like a poison upon the nervous system, and if the suspension of secretion is complete, death soon takes place. Much of the cerebral disturbance accompanying dyspepsia, some forms of which are popularly known as "liver complaint," is doubtless due to deficiency of the biliary secretion and the non-elimination of certain deleterious constituents. (For disease of the liver, *see* BILE, DYSPEPSIA, HEPATITIS, &c.)

LIVERWORT. (*See* HEPATICACEÆ.)

LIZARD, *liz'-ard.*—A genus of saurian reptiles (*Lacerta*), in which many large fossil saurians are often included; but ordinarily the name is restricted to one family, of small size (*Lacertidæ*). They are most numerous in the warmer parts of the eastern hemisphere, are mostly bright coloured, and are fond of basking in the sunshine. The tongue is forked and extensile; the body is long, with a long tail, and the feet have five toes, furnished with claws. There are small scales on the upper part of the body, and larger ones on the lower part, with broad scales around the neck. In this country there are two species—the common or viviparous lizard (*Zootoca vivipara*), and the sand lizard (*L.*

agilis). The former (the most numerous) is four or five inches in length, and of variable colour, brown prevailing; the latter, about seven inches long, generally sandy brown, with darker spots, is less frequently met with. All lizards are harmless, and some species are easily tamed. They become torpid in winter. The tails are easily broken off, but are reproduced.

LLAMA, OR GUANACO, *la'-ma*.—A genus of animals belonging to the class *Mammalia*, order *Ungulata*, family *Bovidæ*, and tribe *Camelina*. The llama bears a strong resemblance to the camel, and may be looked upon as the representative of that animal in the New World, being confined to South America. The ancient Peruvians, however, completely subdued and domesticated the llama as a beast of burden; and to them it answered all the purposes of the camel or dromedary of the Old World. It is estimated that hundreds of thousands were formerly employed to convey ore from the mountains to the coast; but in this they have been superseded by mules and donkeys. In a wild state, the herd keeps a careful look-out, and when disturbed gallops off with great rapidity. There are two distinct species found in South America—the *Lama vicugna* and the *Lama guanacus*. They both inhabit the Peruvian Alps, the Pampas, and the mountains of Chili, extending as far as the Straits of Magellan. The former animal, the vicugna, is principally found in the most elevated land and mountains of Bolivia and Chili. This species is quite wild, and hitherto has defeated all attempts of the aborigines to domesticate it, and has an awkward habit of jumping and kicking with its hind legs. The guanaco is the characteristic quadruped of the plains of Patagonia, and is very common over the whole of the temperate parts of South America. They live in herds, but are easily domesticated after being caught. In their habits they resemble a flock of sheep, and, when caught, appear to have no idea of defending themselves. Two other species of llama, which are thoroughly domesticated, are also mentioned by travellers—the *L. glauca*, which is of a whitish colour, and has long, slender legs; and the *L. Pacos*, which is of a blackish hue, and has short legs. The llama has an extraordinary tendency to spit in the face of any person he dislikes. The wool resembles alpaca, but is rather superior to it. In Mexico, the bones are converted into instruments for weaving the wool. The dung is used for fuel. The llama is rapidly disappearing. (*See also* LAMA.)

LOACH, *lotche*.—A genus of fishes (*Cobitis*) of the family *Cyprinidæ*. The common loach (*C. barbatula*) passes most of its time in the mud of stagnant waters, never frequenting the surface except in stormy weather. It is usually about four inches in length, of a yellowish-white colour, spotted with brown. It feeds upon aquatic insects and worms. The flesh is esteemed by some epicures as a great delicacy. One species, found on the continent of Europe, the lake loach (*C. fossilis*), is 10 or 12 inches long, with longitudinal stripes of brown and yellow.

LOADSTONE. (*See* IRON and MAGNET, NATURAL.)

LOAM, *lome* (Sax., *lam*), a term generally applied to a dark-coloured, rich mould, principally composed of dissimilar particles of earth and decomposed vegetable matter. Loam is moderately cohesive, and therefore neither retentive of moisture, like clay, nor too ready to part with it, like a sandy soil. It is a continued source of carbonic acid, as almost every particle of it is surrounded by an atmosphere of that gas, which is absorbed by the roots of plants, and replaced by atmospheric air, to be again converted into carbonic acid. Upon this transformation, the influence of loam on vegetation may be readily understood; it does not itself nourish plants, but it presents to them a slow and lasting source of carbonic acid which is absorbed by the roots.

LOASACEÆ, *lo-a-sai'-se-e*.—In Botany, the Chili-nettle family, a natural order of *Dicotyledones*, sub-class *Calyciflorœ*. Herbaceous plants with stiff hairs, which are sometimes stinging. Leaves without stipules; calyx superior, 4 or 5-parted, persistent; petals 5 or 10, in 2 whorls, often hooded; stamens numerous, in several whorls, either distinct or united in bundles; ovary inferior, 1-celled, with several parietal placentas, or 1 axile placenta; style 1; ovules pendulous, anatropal. Fruit capsular or succulent; seeds having an embryo lying in the axis of fleshy albumen. The *Loasaceæ* are all natives of North and South America. Several species are cultivated on account of the beauty of their flowers. A Mexican species, *Mentzelia hispida*, possesses a purgative root, which has been used medicinally.

LOBE, *lobe* (Lat., *lobus*).—In Anatomy, is a term applied to the more or less separate parts of which the glands of the body are composed. Thus we have the lobes of the brain, lungs, liver, &c. Lobe is also applied to that pendent portion of the ear which is more fat and fleshy than any other part.

LOBELIA, *lo-be'-le-a* (in honour of Lobel, a botanist).—In Botany, the typical genus of the natural order *Lobeliaceæ*. The most important species is *L. inflata*, Indian tobacco, a native of North America. The flowering herb and seeds have been extensively employed, especially in America, for their sedative, antispasmodic, emetic, and expectorant effects. Lobelia resembles tobacco in its action, but requires to be used with care, as several fatal cases of poisoning have resulted from its empirical use. *L. syphilitica* is reputed to be efficacious in syphilis; *L. urens* has blistering qualities.

LOBELIACEÆ, *lo-be-le-ai'-se-e*.—In Botany, the *Lobelia* family, a natural order of *Dicotyledones*, sub-class *Corolliflorœ*. Herbs or shrubs, with a milky juice. Leaves alternate and exstipulate; calyx superior; corolla monopetalous, irregular, and valvate; stamens 5, syngenesious; ovary inferior, 1—3-celled; placentas axile or parietal: style 1; stigma surrounded by a fringe of hairs. Fruit capsular, dehiscing at the apex. Seeds numerous, albuminous. The plants of this order should generally be regarded with suspicion, as many act as acrid poisons. They are chiefly natives of tropical and sub-tropical regions. There are 29 genera and 375 species.

LOBIPEDIDÆ, *lo-bi-ped'-i-de*, of which Coots and Phalaropes are examples, are a family of aquatic birds of the order *Grallæ*, frequenting fresh and sea waters, being often observed far from land. They are related to Rails, but, unlike them, are partially web-footed, so forming a connecting link between running and swimming birds.

LOBSTER, *lob'-ster* (Ang.-Sax.), (*Homarus vulgaris*), a crustaceous animal belonging to the order *Macroura*, and family *Astacidæ*. When alive, its general colour is a bluish-black, beautifully variegated with paler spots and clouds. Its thorax is smooth, its snout short and serrated, and it has very long antennæ, with two shorter bifid ones between them. The claws and fangs are large, the greater being tuberculated, and the lesser serrated on their anterior edges. It has four pairs of legs; the tail has six joints, and the caudal fin is rounded. The two great claws of the lobster form its instruments of provision and weapons of defence; they open and close like a pair of nippers, and are very strong. The head of the lobster is small, and furnished with two eyes, which are projectile or retractile at will. The mouth resembles that of an insect, opens longitudinally, and is furnished with two teeth for the mastication of its food, and between them is a fleshy substance shaped like a tongue. When the young leave the parent lobsters, they seek the minute crevices of the rocks and other secure places, and in a few weeks they acquire hard, firm shells. Lobsters, like crabs, change their shells every year; previous to this process they appear sick, languid, and restless, and lie torpid and motionless. Three or four days are required before they acquire their new shells, and during that period they are defenceless, and become the prey, not only of fish, but also of such of their own species as are not in a similar condition. While in a soft state lobsters increase in size; and in comparing the dimensions of an old shell with a new, the latter is found to be one-third larger than the former. When boiled, the lobster becomes red. In a commercial point of view, the lobster is perhaps the most important of all the crustaceans, on account of the esteem in which it is held as an article of food. 150,000 are annually sent to Billingsgate Market from the coast of Scotland and the Orkney and Lewis Islands; 600,000 annually arrive there from Norway; and it is not uncommon to see 20,000 to 25,000 lobsters in the market in one day. They are principally sent to London during the period between March and August. According to most accounts, they are very stationary in their habits, and differ in colour and appearance in the different places where they are taken. They are caught in pots, similar to those used in the capture of crabs. Lobsters very readily part with their large claws; and, when seized by one of them, the animal gives it up at once. When suddenly alarmed by a peal of thunder, or the report of a cannon, they shoot their claws immediately. Considerable time elapses before the lost member is restored, and attains the size of the old one.

LOCKED JAW. (*See* TETANUS.)

LOCUS, *lo'-kus*.—A term in Geometry for a line which any given point must necessarily pursue in accordance with the conditions upon which it depends. Thus, a point, moving upon a plane so as to describe a circle, has for its locus the circumference of the circle, out of which it cannot move in any direction, and hence its motion is limited to its locus. A point, with bases arranged for describing an ellipse, to be drawn upon a plane, has for its locus the circumference of the ellipse, which it must necessarily traverse.

LOCUSTS, LOCUSTIDÆ, *lo'-kusts* (Lat., *locusta*, a locust).—In Entomology, a family (*Locustidæ*) belonging to the order *Orthoptera*, and containing many species, all of which resemble grasshoppers; but the locust proper is hardier and more strongly built throughout. Locusts are spread all over the globe, and generally appear in great numbers. The species found in Europe are rather small, but some of the exotic varieties are large. Their food consists of leguminous plants. During spring and the beginning of summer they are in their larva state; but in the latter part of the summer they become perfect insects. Locusts, like many other members of the order *Orthoptera*, have the faculty of producing a harsh, creaking noise, by acting upon their elytra, or wing-covers, with their hind-legs. On account of the veins being considerably elevated in the elytra, and the inner edge of their thighs being rugose with spines, the rubbing of the one against the other produces the noise. Of all the species, the migratory locust (*Locusta migratoria*), although a small insect, is one of the most destructive to man. Its powers of destruction are immense, and as they are produced in great numbers, they soon destroy the vegetation where they are born. After consuming all within their reach, they take flight in swarms to some adjoining district. At times the number of locusts is so great that the sky is absolutely darkened during their passing, and the spots where they alight assume the appearance of a barren waste, almost in an instant. These insects appear periodically in several parts of central Europe, in Egypt, Syria, and almost all the south of Asia, and spread terror and dismay. Considerable rewards are offered for the collection of both the eggs and the perfect insects in the south of Europe. It is on record that in 1613, at Marseilles, 20,000 francs were paid for this purpose. A similar plan is adopted in Turkey and in China. A large species of locust, beauti fully coloured (*Locusta cristata*), is common in Southern Africa, and is very destructive at certain seasons. The inhabitants of some countries make use of the large species of locusts as food. They pull off their wings, and fry them in butter or oil, or pickle them.

LOCUST TREE is a name applied to different kinds of trees in the order *Leguminosæ*, the following being examples:—Carob tree, otherwise also called by the name of locust tree, grows in nearly all the countries surrounding the Mediterranean. It is the tree from which the before-mentioned locust bean is obtained. The false Acacia of America is also known by the name of locust tree, otherwise called Thorn Acacia. In this country it is more generally called simple Acacia. There is another American tree called the honey locust. The West India locust tree (*Hymenæa courbaril*) attains to gigantic growth, and bears pods that yield, when ground, a nutritious meal, not so strongly aromatic as that yielded by the Mediterranean variety, but sweet and agreeable to some tastes, though said to be objected to by others, and liable to cause diarrhœa. The bark produces a resin known as Anime (which *see*).

Locust Wood is yielded by the locust trees of America and the West Indies, the latter being the superior of the two. It is extremely tough and hard, very suitable for cogs of wheels, and unrivalled for trenails.

LOESS, *lo'-es*, a loamy earth, a deposit of the Pleistocene age, containing fossils, found in the Danube and Rhine valleys.

LOGANIACEÆ, *lo-gan-e-ai'-se-e*. — In

Botany, the *Spigelia* or *Strychnos* family, a natural order of *Dicotyledones*, sub-class *Corolliflorœ*, consisting of tropical shrubs, herbs, and trees, with the following characters :—Leaves opposite and entire, with stipules, the latter occasionally existing only in the form of a raised line or ridge ; calyx 4, 5-parted ; corolla regular, 4, 5, or 10-cleft ; æstivation valvate or convolute ; stamens sometimes anisomerous ; anthers 2-celled ; pollen 3-lobed ; ovary 2, 3, or 4-celled ; style simple below, and with as many divisions above as there are cells to the ovary ; stigma simple. Fruit capsular or drupaceo-baccate ; placentas axile, ultimately detached. Seeds usually peltate, sometimes winged, with fleshy or cartilaginous albumen. The *Loganiaceœ* are almost universally poisonous, acting on the nervous system, and producing frightful convulsions. There are 25 genera and about 200 species. (*See* IGNATIA, SPIGELIA, STRYCHNOS.)

LOGARITHMIC CURVE, *log-a-rith'mik.* —A curve in the higher branches of anylitical geometry, which possesses the property of having its *abscissa* proportional to the logarithms of the corresponding *ordinates.*—*Ref.* LESLIE'S *Geometry of Curves.* (*See* CONIC SECTIONS AND GEOMETRY.)

LOGARITHMS, *log'-a-rithms* (Gr. *logos*, proportion ; and *arithmos*, number).—The *logarithms* of numbers may be briefly stated to be the exponents of a series of other numbers, which render the powers of the latter, denoted by the exponents equal to the former series. In most elementary mathematical works, the definition of the word is thus given :—The logarithm of a number y is such a value of the index x, of a *fixed* magnitude a, as will satisfy the equation $y=ax$: that is, x is *defined* to be the logarithm of y in a *System of Logarithms*, whose *base* is a : and the logarithm of y will therefore depend entirely upon the quantity a, which may be assumed to be any finite magnitude whatever,—*unity* only excepted, on account of every arithmetical power or root of 1 being only 1, which thus prevents that number from obeying the conditions stated above. In order, therefore, to constitute a logarithm, it is necessary that the exponent should refer to a system, or series of numbers, in arithmetical proportion, corresponding to as many others in geometrical proportion. If we take, for example, the series of 10, we have $10^1=10$; $10^2=100$; $10^3=1{,}000$; and $10^4=10{,}000$: we thus attain the results that the logarithm of $10=1$; the logarithm of $100=2$; of $1{,}000=3$; and of $10{,}000=4$. This can be thus explained, by saying that a logarithm is a mathematical term for a number, by which the magnitude of a certain fundamental ratio is expressed in reference to a fixed fundamental ratio. Thus, in the two runs of arithmetical and geometrical proportion, the numbers thus proceed :—

Ar. Pro. ..	0,	1,	2,	3,	4,	5,	6,	&c.	
Geo. Pro. ..	1,	2,	4,	8,	16,	32,	64,	&c.	

If we add 1 and 3 together in the first line, 4 corresponds to 16 (standing under it), which is identical with the multiple of 2 and 8, which stand under the 1 and 3. The upper line in arithmetical proportion forms the logarithms of the lower, in geometrical proportion, and logarithmic tables furnish these intermediate fractions, corresponding with the intermediate numbers in the lower line. A table of logarithms, made according to an assumed basis or fundamental ratio of all numbers to a certain limit, is called a *logarithmic system*. Logarithms were first invented by Lord Napier, Baron of Merchiston, in Scotland ; and were first made known by him in a work published in 1614, under the title, "De Mirifici Logarithmorum Canonis Constructione." This system was varied by Henry Briggs (a contemporary of Lord Napier), who constructed another system, having for its base the number 10, which, corresponding with our system of numeration, has many advantages over that constructed by Napier, being much more convenient for ordinary purposes of calculation. Briggs calculated his on the fundamental basis of the ratio 10 to 1 : consequently, the logarithm of 10 is 1 ; of 100, 2 ; of 1,000, 3 ; and so on. It is, therefore, evident that all logarithms of numbers between 10 and 1 must be more than 0, but less than 1 ; in other words, must be fractions ;—thus, the logarithm of 6 is 0·7781513. Again, all logarithms of numbers between 10 and 100 must be greater than 1, but less than 2 ; that is to say, must be whole numbers *plus* a fraction ; for instance, the logarithm of 95 is 1·9777236. The properties and advantages of logarithms are very great by their utility in facilitating the arithmetical operations of multiplication and division, which, when large numbers are concerned, usually take up much time. If the multiplication of two large numbers has to be effected, it is only necessary to take from the logarithmic tables the logarithms of numbers in question ; add these together, and the result will be the logarithm of the required product. In division, logarithms of the numbers have merely to be deducted from each other, and the result will be the logarithm of the dividend. If numbers have to be raised to powers, then logarithms are multiplied ; if roots are to be extracted, the logarithms are merely to be divided by the exponent of the root. The integral part of a logarithm is called its *characteristic*, because it shows at once of how many digits the natural number corresponding to the logarithm to which it is prefixed is composed. If, therefore, we know the logarithm of any number, we need only add 1, 2, 3, &c., to its characteristic, in order to obtain the logarithm of a number 10 times, 100 times, or 1,000 times as great. For instance,—

$$
\begin{aligned}
\log.\ 73594 &= 4\cdot8668424 \\
\log.\ 7359\cdot4 &= 3\cdot8668424 \\
\log.\ 73\cdot594 &= 1\cdot8668424 \\
\log.\ 7\cdot3594 &= 0\cdot8668424 \\
\log.\ \cdot73594 &= \bar{1}\cdot8668424
\end{aligned}
$$

In this last example, the negative sign is only placed over the characteristic, as that alone is negative ; but the general mode of procedure with regard to these minor logarithms is to give them their arithmetical complements, substituting the real value in the final result. In the Napierian system, the *modulus*, or basis, of the tables is 1 ; and consequently the Napierian logarithm is easily found from the common logarithms (those of Briggs), by multiplying the modulus of the latter by $l\frac{1}{10}$. The Napierian logarithms are often called *natural logarithms*, on account of the modulus of their system being unity ; while the common logarithms of Briggs are called *tabular logarithms*, in contradistinction to the former. The method which was first employed to compile logarithmic tables was founded on the successive extraction of roots, and consequently calculations arose of vast difficulty and tedium ; in the present day, however, the method is far more simple, and the computations are thus rendered much more expeditiously. Suppose, for instance, it be required to find the lorarithm of any number x, by means of converging series. In the first place it must be assumed that log. $(1+x)=Ax+Bx^2+Cx^3+Dx^4+$ &c. (1), in which A, B, C, D, &c., are coefficients, like determinates. (*See* CO-EFFICIENTS.) Therefore, taking another number, z, we have, in a similar manner, log. $(1+z)=Az+Bz^2+Cz^3+Dz^4$ &c. (2); then subtracting the second equation (2) from the first (1), we shall have the result—

$$\log.(1+x)-\log.(1+z)=A(x-z)+B(x^2-z^2)$$
$$+C(x^3-z^3)\,\&c. \quad (3)$$

But from the properties possessed by logarithms, we know that $\log.(1+x)-\log.(1+z)=\log.\frac{1+x}{1+z}=$ $\log.\left(1+\frac{x-z}{1+z}\right)$; and on our bringing out the equation by the same means as log. $(1+x)$ was treated in the first equation, we obtain the result that $\log.\left(1+\frac{x-z}{1+z}\right)=A\frac{x-z}{1+z}+B\left(\frac{x-z}{1+z}\right)^2+$ &c. Substituting, therefore, this development for log. $(1+x)$ $-$ log. $(1+z)$ in the third equation (3), and dividing both by $(x-z)$, there results—

$$A\frac{1}{1+z}+B\frac{x-z}{(1+z)^2}+C\frac{(x-z)^2}{(1+z)^3}+\&c.$$
$$=A+B(x+z)+C(x^2+xz+z^2)+\&c.$$

Now, as this equation is true independently of any particular values of x and z, let us suppose that $z=z$, and it becomes—

$$A\frac{1}{1+z}=A+2Bx+3C^2+4Dx^3+\&c.$$

which, on expanding the quantity $\frac{1}{1+x}$ by division, gives $A(1-x+x^2-x^3+x^4-\&c.=A+2Bx+3Cx^2$ $+4Dx^3+$&c. Therefore, by the theory of indeterminate coefficients, we must have the separate equations $A=A$, $-A=2B$, $A,+3C$, $A=4D$, &c.; and on substituting the resulting values of B, C, D, &c., in terms of A in equation (1), we get—

$$\log.(1+x)=A\left(\frac{x}{1}-\frac{x^2}{2}+\frac{x^3}{3}-\frac{x^4}{4}+\frac{x^5}{5}-\&c.\right)$$

The quantity A, which is still indeterminate, being the modulus, and assigning to it any particular value, we can at once characterize the system which we wish to consider. It would be impossible in the present article to enter at length upon the different theorems for the compilation of logarithmic tables, and nearly as useless, as the tables at present in existence are amply sufficient for all practical purposes.

LOGOMANIA, *lo'-go-ma'-ni-a.*—A state of mental paralysis, wherein the patient partially or entirely forgets the designation of what he wishes to express. In some cases a logomaniac has been known to forget his own name. A commoner case is where the speaker says, for instance, "beautiful rose is," when he means to say "the rose is beautiful."

LOGWOOD, *log'-wood.*—A very valuable dyestuff, consisting of the cuttings or raspings of the wood of the *Hæmatoxylon campechianum*, a tree growing in Mexico and the neighbouring countries. It is extensively employed for dyeing black with alum; but acids immediately change the colour to red. Its dyeing properties are due to its containing a crystalline matter called *hæmatoxylon*, which is straw-yellow in its pure state, but assumes a brilliant red under the influence of oxygen and alkalies. Solid logwood is so heavy as to sink in water. It will yield its properties to water, but more perfectly to alcohol. Stuffs previously prepared with alum and tartar take this dye better. (*See also* HÆMATOXYLON.)

LOIMIC, *lo-im'-ik* (Gr., *loimos*, contagion).—In Medicine, denotes relationship to the plague, or to contagious disorders.

LOINS, *loinz.*—The lower and posterior part of the trunk of the body, or the space between the upper edge of the pelvis and the last of the ribs. The lower end of the vertebral column is in this region, and the vertebræ composing it are termed the lumbar vertebræ.

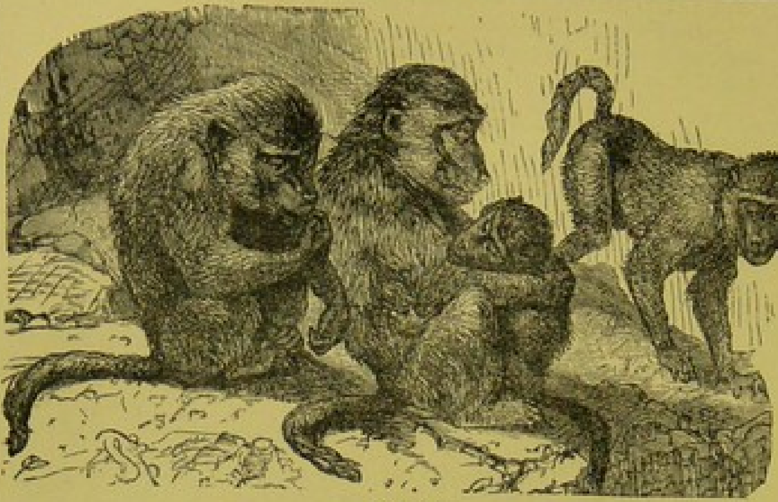
LOMENTUM, *lo-men'-tum* (Lat.), in Botany, a kind of fruit. It may be described as a *legume* or *pod*, which is contracted between each seed in a moniliform manner. When ripe, the lomentum commonly separates into as many pieces as there are contractions on its surface; sometimes, however, it remains entire.

LONCHIDITE, *lon'-ki-dite.*—A variety of iron pyrites found in Cornwall and in some places on the continent.

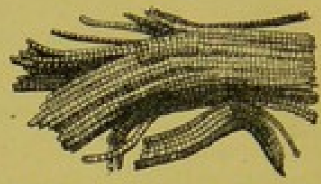
LONDON CLAY, *lun'-dun klay.*—A term applied in Geology to the older group of regularly-deposited tertiary strata in England. It is distinguished from the more recent group, which is called "crag." The different strata which together compose what is called the London clay deposit, are chiefly exhibited in basin-shaped depressions in the chalk, one of which occurs between the line of the North Downs and the chalk of Cambridgeshire, Hertfordshire, and Suffolk; and another between the South Downs and the continuation of the same range into Dorsetshire and the English Channel: the former is called the London, and the latter the Hampshire basin. In the Isle of Wight there is also a third basin, remarkable for the presence of some fresh-water fossiliferous strata, not found in the other parts of the formation. London clay proper consists of tenacious brown and bluish-grey clay, with layers of concretions called septaria, which chiefly abound in the brown clay, and are obtained in sufficient quantities from the cliffs near Harwich, and from shoals off the Essex coast, to be used in the manufacture of Roman cement. The principal localities of fossils in the London clay are Highgate Hill, near London, the Isle of Sheppey, and Bognor, in Hampshire. The total thickness of the London clay amounts to considerably more than a thousand feet. Its lower part consists of an indefinite number of beds of sand, shingle, clay, and loam, irregularly alternating with one another, and formerly looked upon as a distinct formation, and described under the name of the "Plastic Clay." The remains of the hippopotamus, elephant, and other quadrupeds have been found in this clay. The presence of the fossils of crocodiles, turtles, shells of the genus nautilus, and many curious fruits, lead geologists to believe that the climate of the era when the London clay was deposited was warm and nearly tropical.

LONGAN is a remarkably fine fruit, grown upon a tree which is a native of Lima.

LONGEVITY, *lon-jev'-e-te* (Lat., *longa vita*, long life), signifies length of life. The age recorded of men who lived before the deluge reaches upwards of 900 years. After the Flood, Shem is the only one that we read of who reached the age of 500. In the 2nd century we do not find that any reached the age of 240; and



MONKEYS.



FIBRILS OF VOLUNTARY MUSCLE, MAGNIFIED.

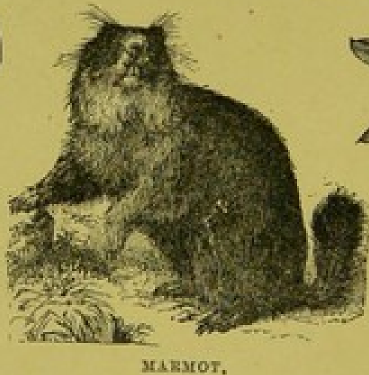
THE SAME, MORE HIGHLY MAGNIFIED.

MUSK OX.

1. MYRH.
2. FRANKINCENSE.

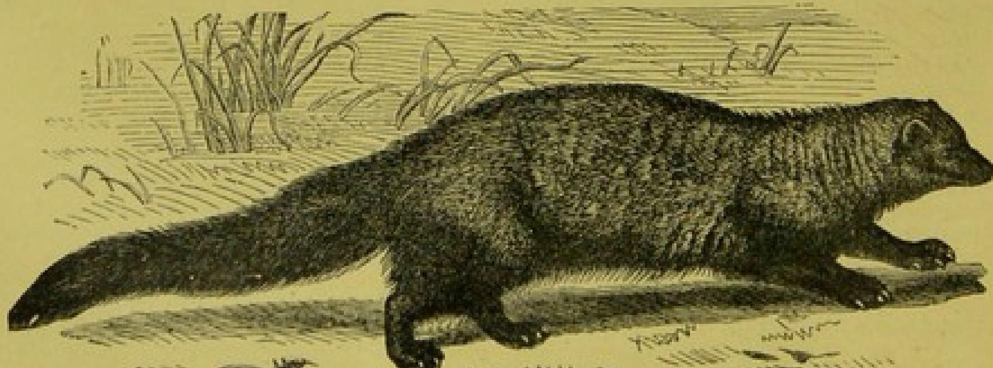
MARMOZET.

MACAW.



MARMOT.

MAGNOLIAS.



MARTEN, FISHER.

in the third century (about the latter end of which Abraham was born), none except Terah arrived at 200. The records eventually refer to 70 or 80 years; and there it has stood ever since, and few persons have exceeded that limit. Many instances are cited of men living in the ancient world more than 100 years, but considerable doubt attaches to such records. Lord Bacon, in his "History of Life and Death," quotes as a fact unquestioned, that a few years before he wrote, a morris dance was performed in Hertfordshire, at the May games, by eight men, whose united ages amounted to 800 years. In the 17th century, some time after Bacon wrote, two Englishmen are reported to have died at ages greater than almost any of those which have been attained in other nations. According to documents which are printed in the "Philosophical Transactions of the Royal Society," Thomas Parr lived 152 years and 9 months, and Henry Jenkins 169 years. The evidence, however, in these cases is by no means conclusive, as it evidently rests on uncertain tradition, and on the very fallible memories of illiterate old men.

LONGICORNS, *lon'-je-korns* (Lat., *longus*, long; *cornu*, a horn).—An order of coleopterous insects, so called on account of the length of their antennæ, which are generally longer than their bodies, and very seldom shorter. Longicorn insects also possess other distinctive characters. The under part of the first three joints of the tarsi, in all of them, is furnished with a brush; the second and third joints are cordiform; the fourth is deeply bilobate; and at the base of the last there is a little nodule, resembling a joint. The antennæ are either filiform or setaceous; being sometimes simple in both sexes, and sometimes serrate, pectinate, or flabelliform in the males. In some species, the eyes are rounded and entire; in others, slightly emarginate; in the latter case, the thorax is trapezoidal or narrowed anteriorly. In most cases, however, the eyes of the longicorns are reniform, and surround the base of the antennæ. The larvæ of a great number of the longicorns are destitute of feet, or have very minute ones, as a large proportion of them live in the interior of trees or under the bark. Their body is soft, whitish, and thickest in the fore part; and the head is squamous, and furnished with strong mandibles. The larger varieties of the longicorns often do great damage to trees, sometimes drilling them in every direction. Some species attack the roots of plants.

LONGIPENNES.—In Ornithology, is the order of *Palmipedes*, having great power of flight with long wings. The most familiar example is the Stormy Petrel.

LONGIROSTRES is the name of a tribe of birds to which the snipe and the woodcock belong.

LONGISSIMUS DORSI, *lon-jis'-si-mus dor'-si* (Lat., the longest [muscle] of the back).—In Anatomy, is a muscle of the back, which rises from the posterior surface of the os sacrum and transverse and oblique processes of the lumbar vertebræ, and is inserted by small double tendons into the posterior and inferior part of all the transverse processes of the vertebræ of the back, sending off also bundles of fibres to all the ribs between their tubercles and angles. Its use is to support the spine, and bend it backwards and to one side.

LONGITUDE. (*See* LATITUDE AND LONGITUDE.)

LONG SIGHT.—When the eye cannot plainly distinguish small objects at usual distances. It arises when the *crystalline lens* is not sufficiently convex.

LONGUS COLLI, *long'-gus kol'-li* (Lat., the long [muscle] of the neck).—In Anatomy, is a muscle situated close to the anterior and lateral part of the vertebræ of the neck. It rises from the three superior vertebræ of the back, and is also connected by tendons with the four last vertebræ of the neck, being inserted into the fore part of the second vertebra of the neck, near its fellow. Its use, when acting singly, is to move the neck to one side; but, when both act, they serve to bring the neck directly forwards.

LONICERA, OR HONEYSUCKLE, *lon-is'-e-ra* (*Lonicera*, named after Adam Lonicera, a German botanist, who died in 1586).—A genus of very ornamental shrubs, closely allied to the genus *Caprifolium*. The species grow in any common soil, and are readily increased by cuttings taken off in autumn and planted in a sheltered situation. There are several indigenous species in England, amongst the best known of which are—1. The pale perfoliate honeysuckle (*L. caprifolium*), which grows in woods and thickets, but is not common; when it meets with support, it grows to a considerable height. The leaves are sometimes used in detersive gargles. 2. Common honeysuckle, or woodbine (*L. periclymenum*), is a common shrub in almost every grove, thicket, and hedge, and flowers from June to October. This is a favourite plant in gardens and shrubberies. Goats are very partial to the leaves of woodbine, for which reason the French call the plant *chèvre-feuille* (goat-leaf). 3. The upright fly honeysuckle, a species which flourishes in thickets and rocky places. It is a shrub of little beauty, and no known utility. The flowers, however, of several of the species are highly fragrant and ornamental, and the form of the common European honeysuckle is supposed to have given rise to one of the most beautiful ornaments of Grecian architecture.

LOON. (*See* DIVERS.)

LOOSESTRIFE. (*See* LYTHRACEÆ.)

LOPHOBRANCHII are osseous fish, of which the Pike Fish is an example.

LOQUAT, *lo'-kwat.*—The fruit of the *Eriobotrya japonica*, a rosaceous plant.

LORANTHACEÆ, *lo-ran-thai'-se-e.* —In Botany, the Mistletoe family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*. Parasitic shrubby plants, more remarkable for their curious mode of growth than for their useful properties. One species, *Loranthus tetrandus*, a native of Chili, produces a black dye. The mistletoe yields a viscid pulp, used for making birdlime. (*See* VISCUM.)

LORIS is a genus of Lemur, with a round head, large eyes, and without a tail. They are nocturnal in their habits, and sleep during the day in trees, feeding upon insects, fruit, milk, and eggs. Their fur is excellent. One species, of a reddish colour, is a native of the Gold Coast, Western Africa. The "slow-lori," yellowish grey, with a dark torsal band, is met with in Bengal, Siam, Borneo, and Sumatra.

LORY, *lo'-re.*—A bird of the Parrot family; sub-family *Lorianæ*. Some of the species are very handsome. They are mostly natives of Borneo, the Moluccas, and New Guinea.

LOTUS, *lo'-tus.*—This name is given by the Greeks to various different plants the fruit of which was used for food. The Zizyphus Lotus is a native of the north of Africa and south of Europe, and belongs to the natural order *Rhamneæ*. (*See* JUJUBE.) The lotus of the ancient Egyptians, held sacred to Osiris and Iris, and regarded as signifying the creation of the world, *Nelumbium speciosum*, a fine aquatic plant. The blue lotus of the Nile, *Nymphæa lotus*, is also represented as decorations upon ancient Egyptian remains; and appears also to be a favourite subject with Chinese artists. In Hindoo mythology the lotus, or "nelumto," is prominent—the deities being represented as sitting on the expanded flower.

LOUSE, *lowse* (Sax., *lus*), a term applied to certain disagreeable and unseemly parasitic insects. They are distinguished by having six feet formed for walking, a mouth furnished with a proboscis, antennæ as long as the thorax, with the abdomen, which is formed of several segments, depressed. Many, if not all mammals, and perhaps all species of birds, are infested with lice; and it would appear that each species of mammal and bird has its own peculiar species of louse, and sometimes even two or three distinct species. They breed very rapidly, several generations occurring in a short period. Their increase seems to be favoured by certain circumstances—as infancy, and that condition of the system which gives rise to *phthiriasis*, or the lousy disease. The human species is subject to the attacks of several species; among which are the *Pediculus humani corporis*, or body louse, principally occurring in adults who are dirty in their personal habits; and the *P. humani capitis*, or common louse, most frequent in children. The best antidote against these disgusting insects is cleanliness. Although of rare occurrence now, the lousy disease was not unfrequent among the ancients. Herod, Antiochus, Callisthenes, Sylla, and many others, are supposed to have perished from this complaint.

LOVAGE. (*See* LEVISTICUM.)

LOVE APPLE. (*See* TOMATO.)

LOVE BIRDS.—A very small group of the Parrot family, natives of the warm parts of America, Africa, and Australia. They are very small and beautiful in appearance. The name is derived from the great affection they display for each other. They are best kept in parties in one cage, and otherwise thrive when treated as canaries.

LOXODROMIC LINES, *lox-o-dro'-mic* (Gr., *loxos*, oblique; *dromos*, course).—Curves on a sphere which intersect all the meridians of the sphere at the same angle.

LUCID INTERVAL in mental affliction corresponds to intermission in cases of fever.

LUCINA, *lu-see'-na.*—A kind of shell-fis that burrows in sand or mud under water, also numerous as fossils.

LUNAR CYCLE. (*See* METONIC CYCLE.)

LUFFA, *luf'-fa* (from *louff*, its Arabic name).—In Botany, a genus of the natural order *Cucurbitaceæ*, or Gourd family. *L. purgans* and *drastica* have fruits which are violently purgative. They constitute the drug commonly called *American colocynth*. The fruit of *L. fœtida*, termed the *sponge-gourd*, consists of a mass of fibres entangled together: these fibres are used for cleaning guns.

LUG-WORM, OR LOG-WORM, is the name of the worms that are found in such numbers in the sand of the sea-beach at low water. The lug-worm is much larger than the earth-worm. It is much thicker at the mouth end than at the tail. Near its middle it has gills. It is excellent bait for fishermen, the unctuous, yellowish matter it exudes when touched rendering it a dainty morsel for a fish.

LUMBAGO. (*See* RHEUMATISM.)

LUMBAR, *lum'-bar* (Lat., *lumbus*, the loin).—In Anatomy, denotes of or belonging to the loins; as, lumbar region, &c. (*See* LOINS.)

LUMINOSITY OF ORGANIC LIFE AND DEAD MATTER. (*See* LIGHT.)

LUMPSUCKER, OR LUMPFISH.—A name given to several spiny-rayed fishes of the family *Discoboli*. (*See* DISCOBOLI.) The first name is popularly given because of the remarkable power of sucking, which, when exercised upon a considerable weight, will lift it if the fish be taken up by the tail. The common lumpfish, found on both sides of the Atlantic, varies from 8 to 20 inches in length, frequents the coasts of Britain, especially those of Scotland, and is good eating when in season. Other varieties are found on the coast of Greenland and South Africa.

LUNAR ECLIPSE, *lu'-nar* (Lat., *luna*, the moon).—When the moon passes through the earth's shadow, a portion of the light which usually falls upon the surface of the former is intercepted, and the phenomenon is called a lunar eclipse. The region in which there is only a partial interception of light is called the penumbra. The moon, if she revolved in the plane of the ecliptic, would pass through the shadow of the earth on each occasion that the earth came between her and the sun; consequently there would be an eclipse every month; but the lunar orbit being inclined to the plane of the ecliptic at a mean angle of somewhat more than five degrees. A lunar eclipse can only occur when the moon is near either of the nodes of her orbit—that is, when the orbit of the moon intersects the orbit of the earth. By calculation, it has been found that when the distance of the node from the points of the ecliptic opposite to the sun exceeds $11^\circ\ 25'\ 40''$, there can be no eclipse; but if the distance of the node from the same point is less than $9^\circ\ 20'\ 29''$, there must be an eclipse. When there is a total lunar eclipse, that is, when the moon is completely enveloped in the earth's shadow, she is still visible, her surface appearing of a dull copper-colour, on account of the refraction of the light passing through the earth's atmosphere. The air has the property of absorbing the violet rays of solar light; hence the reddish colour presented by the moon. In the course of a year there may be three lunar eclipses, which is the largest number that can happen; but there must always necessarily be two.

LUNAR EVECTION.—A term applied in Astronomy to an inequality in the longitude of the moon, caused by the disturbing force of the sun.

LUNAR THEORY is applied to the deduction that the motions of the moon are mainly due to the principle of gravitation.

LUNGS, *lungs* (Sax., *lungen*), in Anatomy, are two large conical bodies placed one in each of the lateral cavities of the chest, and separated from each other by the heart and large vessels and by two layers of the pleura, which form the mediastinum, or median partition. They occupy by far the larger portion of the cavity of the chest, and during life accurately adapt themselves to its varying dimensions. Each lung is invested by an exceedingly delicate serous membrane, termed the pleura. The portion investing the surface of the lung is called the *pleura pulmonalis*, while that which lines the inner surface of the chest is called the *pleura costalis*. The root is that part of the lung which is connected to the heart and the trachea; being formed by the bronchial tube, the pulmonary artery and veins, the bronchial arteries and veins, &c., all of which are inclosed by a reflection of the pleura. Each lung is divided into two lobes, a lower and an upper, by a long and deep fissure, which commences upon the upper portion of the posterior border of the lung, about three inches from the apex, and extends obliquely downwards and forwards to the lower part of the anterior border, penetrating nearly to the root of the organ. The upper lobe is smaller than the lower, and is conical, with an oblique base, while the lower lobe is more or less quadrilateral. In the right lung, the upper lobe is partially divided by a second and shorter fissure, extending from the middle of the principal fissure forwards and upwards to the anterior margin of the organ, and marking off a small triangular portion, called the middle lobe. The right lung has thus three lobes, and is larger and broader than the left. The lungs are heavier in the male than in the female, being in the former in proportion to the body as 1 to 37, in the latter as 1 to 43. The substance of the lung is of a light, porous, spongy texture, and when healthy, is buoyant in water; but in cases of congestion or consolidation from disease, the entire lungs, or portions of them, will sink in that fluid. The substance of the lung itself is composed of numerous small lobules, which, although closely connected together by an interlobular areolar tissue, are quite distinct from one another. These lobules are of various sizes, those on the surface being large and of a pyramidal form, with the base turned toward the surface; those in the interior being smaller, and of various forms. Each lobube may be regarded as a lung in miniature, the same elements entering into its composition as go to form the lung itself. Each is composed of one of the ramifications of the bronchial tube and its terminal air-cells, of the ramifications of the pulmonary and bronchial vessels, lymphatics, and nerves; all being connected together by areolar fibrous tissue. Each bronchus, on entering the substance of the lung, divides and subdivides dichotomously throughout the entire organ. Sometimes three branches arise together; and occasionally small lateral branches are given off from the sides of a main trunk. Each of the smaller divisions of the bronchi enters a pulmonary lobule, and again subdividing, ultimately terminates in the intercellular passages of the air-cells, of which the lobule is composed. After entering the substance of the lobules, each lobular bronchial tube is said to divide and subdivide from four to nine times, according to the size of the lobule, diminishing in size until they attain a diameter of $\frac{1}{50}$ to $\frac{1}{30}$ of an inch, when they become changed in structure, lose their cylindrical form, and are continued onwards as irregular intercellular passages through the substance of the lobule. The pulmonary artery conveys the venous blood to the lungs. It divides and subdivides into branches, which accompany the bronchial tubes, and terminates in a dense capillary network upon the walls of the intercellular passages and nerves. From this network, the radicles of the pulmonary veins arise, and, coalescing into large branches, at length accompany the arteries and return the blood, purified by its passage, through the capillaries to the heart. The lungs are the great organs of respiration. The air passes through the bronchial tubes until it reaches the minute air-cells, on the walls of which the blood circulates in a network of capillaries in such a way that it is brought into immediate connection with the atmospheric air, which is drawn in by each inspiration. In the act of breathing, the capacity of the chest is increased by the action of certain muscles, when the air rushes in to fill the vacuum, and expansion of the lungs takes place; and then, the muscular movement ceasing, the ribs, by their weight and elasticity, contract and force out the air. From fifteen to twenty-two is the average number of respirations in a minute; but this number may be very greatly increased by excitement, exercise, or disease. The lobules are not all distended with air in ordinary inspiration, nor by the most powerful efforts that can be made. Those of the upper parts of the lungs seem to be most filled, and are most constantly in action. The average quantity of air contained in the lungs is estimated at about 200 cubic inches. In each ordinary act of inspiration, or expiration, a change of from 20 to 30 cubic inches is supposed to take place. The lungs, from their highly-organized structure and their incessant exercise, are perhaps more liable to disease than any other part of the body. The diseases to which they are mostly liable are, in their first stages at least, of an inflammatory character, and are mostly produced by exposure to damp and cold, sudden atmospheric changes, and transitions of temperature, want of proper nourishment, &c. The air discharged from the lungs, in addition to chemical changes, is charged with watery vapour, which is said to vary from 6 oz. to 27 oz. in 24 hours, however dry the outer air may be. The greater part of this vapour is merely aqueous, but a portion of it arises from the combustion of hydrogen and carbon in the system. It is estimated that of the hydrogen contained in food, nine-tenths is so discharged as a product of combustion. In addition to the water and hydrogen, the lungs simultaneously discharge carbonic acid, albumen in a state of decomposition, and a small quantity of ammonia. Syphilis of the lungs seems to be very frequent, for one private medical practitioner has placed upon record 110 cases in Berlin alone. From this and other sources it is deemed important to distinguish lung disease arising from syphilis and that known as consumption. It seems likely that one has been often mistaken for the other, with fatal consequences. The state of the lungs can now be ascertained with tolerable certainty by means of auscultation (which *see*). For particular diseases of the lungs, *see* ASTHMA, BRONCHITIS, HÆMOPTYSIS, PLEURITIS, PNEUMONIA, PHTHISIS.

LUNG-WORT.—A perennial herb (*Pulmonaria officinalis*), of the Borage family, a native of Europe. The flowers, which appear in spring, are terminal clusters, orange-coloured, but change to blue. Old herbalists believed in the value of the leaves as a remedy for pulmonary complaints, but apparently only because they somewhat resembled the lungs in appearance.

LUPINE, *lu'-pine*, is the name of a genus of plants, inferior specimens of which grow in Britain, and bear flowers of various colours, some being white, others yellow, pink, or blue. They belong to the genus *Lupinus*, a sub-order of the *Leguminosæ*, and contain about 80 species, the greater number natives of America. When developed by great heat, the seeds form a valuable farinaceous food, for which they are cultivated. They are good for draught cattle, and are liked by some persons, but not by others, there being a peculiar bitterness about them.

LUPUS, *lu'-pus* (Lat., *lupus*, the wolf).—A constellation of the southern hemisphere, which originally formed part of the constellation Centaurus, according to Aratus and Ptolemy. It lies to the south of Scorpio, having Centaurus on one side of it and Ara on the other. Its largest star is one of the third magnitude.

In Pathology, *lupus* is a name given to a malignant disease of the face, which eats away the parts attacked with great rapidity; and hence its comparison to a wolf.

LURCHER, *lur'-tsher*.—A sort of hunting-dog, resembling a mongrel greyhound, with pricked ears, a shaggy coat, and generally of a yellowish-white colour. It runs very swiftly, so that, if it get between the burrows and the rabbits, it seldom misses taking them; in hunting, this is its usual practice. The lurcher is much used by poachers.

LUTIDINE, *lu'-te-deen*.—One of the elements of bone oil, its counterpart being also contained in naphtha, and can be produced from peat

LUXATION, *luks-ai'-shun* (Lat., *luxatio*, from *luxo*, I put out of joint).—In Surgery is the dislocation of a bone from its proper cavity. (*See* DISLOCATION.)

LUXULIAN, *lux-u'-li-an*, is a kind of granite, with green veins, found in Cornwall.

LUZULA, OR WOOD RUSH, *lu-zu'-la*.—Plants resembling rushes, but bearing three seeds in each capsule, instead of many. The leaves also have peculiar hairy appendages, which distinguish the luzula from the ordinary rush. They grow in meadows and woods, and not in and about water, as common rushes do. It is sometimes called the Field Rush, and grows in the shade, retaining its verdure during the winter.

LYCAON, *lik'-a-on*, is a kind of wild dog resembling in some respects the hyæna. It is something like a thin mastiff, and being gregarious throughout Southern Africa, makes havoc amongst flocks near the Cape and elsewhere. (*See* HYÆNA.)

LYCANTHROPY, *li-kan'-thro-pe* (Gr., *lukos*, a wolf, and *anthropos*, a man), is defined by Cotgrave to be "a frenzie or melancholie which causeth the patient (who thinks he is turned woolf) to flee all company, and hide himself in dens and corners." Herodotus says that, according to the Scythians, every Neurian once a year changes himself for some days into a wolf, and afterwards resumes his own shape; but adds, "they cannot make me believe such stories, though they not only tell them, but swear to them." A similar superstition is noticed by Virgil in his eclogues, Pliny, Pausanias, and other writers. A belief in lycanthropy appears to have been extremely prevalent in the 16th century, and numerous authentic narratives remain to us of victims committed to the flames for this practice, for the most part in consequence of their own confessions. They were called *loups garous* by the French, *were-wolves* by the Anglo-Saxons, *wehr-wölfe* by the Germans, and were believed to be extremely ferocious, devouring not only beasts, but human beings. From the prevalence of this superstition, many persons were led to believe themselves wolves, and to imitate the howl and actions of these animals; a species of insanity to which the term lycanthropy was also applied. It was said to manifest itself "by the patient's going out of doors at night and imitating the actions of wolves, and in the day-time wandering in burial grounds."

LYCHNIS, *lik'-nis* (Greek, *luknos*, a light or lamp).—An herbaceous plant, belonging to the Pink family. One familiar species is generally known in meadows as the Ragged Robin or Cuckoo Lychnis. It has double pink flowers.

LYCOPERDON, *li-kop'-er-don*, in Botany, the Puff-ball, a genus of *Fungi*. When the species *L. giganteum* is submitted to combustion, fumes arise which are powerfully narcotic. In this way the fungus has been employed to stupefy bees when removing honey from the hive. Lately, the vapour has been proposed as an anæsthetic agent, instead of chloroform.

LYCOPERSICON, *li-ko-per'-si-kon*.—In Botany, a genus of the natural order *Polemoniaceæ*. The species *L. esculentum* produces the juicy acid fruits called *love-apples*, or *tomatoes*, much employed in the preparation of sauces.

LYCOPODIACEÆ, *li-ko-po-de-ai'-se-e* (Gr., *lukos*, wolf; *pous*, foot).—In Botany, the Club-moss family, a natural order of *Acotyledones*, sub-class *Acrogenæ*. Herbaceous plants, usually resembling mosses, with creeping stems and forked ramification; or aquatic plants, with corn-like stems. The order includes six genera and about 200 species, which occur in cold, temperate, and warm climates.

LYCOPODIUM, *li-ko-po'-de-um*.—In Botany, the typical genus of the natural order *Lycopodiaceæ*. The species *L. clavatum* is the common club-moss, an inconspicuous plant found on heaths. It possesses well-marked emetic and purgative properties. The spores have been employed externally for their absorbent qualities in erysipelas and various cutaneous affections. They are of a yellow colour, and are sometimes styled *vegetable sulphur*. They are commonly employed in pharmacy for covering pills, the object sought being to render the pills tasteless, and to prevent their adhering together. The spores are highly inflammable, and are much used in the preparation of fireworks, and in the production of artificial lighting at the theatres.

LYDIANSTONE is another name for Touchstone or Basanite. It is a kind of jasper, and is used in testing precious metals.

LYGODIUM, *li-gode'-e-um* (Greek, *lygodes*, flexible).—A genus of climbing ferns, with much divided leafy fronds. There are many species, natives of warm countries, extending to North America, New Zealand, and Japan. Only one species, however, *L. palmatum*, is found in North America.

LYME GRASS grows on sandy shores, and is little regarded in Britain, but a large variety is advantageously cultivated in Holland; and the seed from it, grown in Iceland, is a substitute for other grain as food. The grass is also turned to account for thatch.

LYMPH, *limf* (Lat., *lympha*, water).—In Physiology, a thin, transparent, colourless fluid, which is found in the lymphatic or absorbent vessels abundantly distributed over the body. (*See* LYMPHATICS.) Its taste is saline, and it has a faint, scarcely perceptible, smell. When examined with the microscope, it is seen to consist of a clear liquid, with corpuscles floating in it, which agree entirely with the pale corpuscles of the blood. The liquid part bears a strong resemblance in its physical and chemical constitution to the plasma of the blood. The constituent parts of lymph are as follows :—

Water	96·926
Fibrin	·520
Albumen	·434
Ozmazome	·312
Fatty matters	·264
Salts	1·544
	100·

Lymph is a nutritious fluid, and not excrementitious, as was maintained by Hewson and Hunter.

LYMPHATICS, *lim-fat'-iks.* — In Anatomy, the name given to a class of vessels in the human body, from their containing lymph. They are also called absorbents, from the property they possess of absorbing certain materials for the replenishing of the blood, and conveying them into the circulation. The lymphatics are exceedingly delicate vessels, their coats being so transparent that their fluid contents are readily seen through them. They are found in nearly all the textures and organs of the body which receive blood, with the exception of the substance of the brain and spinal cord. In the different regions of the body, and in the several internal viscera, they are arranged into a superficial and a deep set—the former running immediately beneath the skin, or under the membranous coats enveloping internal organs; the latter usually accompanying the deep-seated blood-vessels.

LYNX, *links* (Lat.)—A general name applied to the short-tailed *Felidæ*. Under this head several species were formerly confounded by Linnæus, and at the present day there is still much confusion with respect to them. *Felis cervaria*, the largest and most beautiful, is found in Asia and Europe. *Felis lynx*, the European lynx, has become rare, and is only found in the Pyrenees and parts of the Apennies. In length this animal is about three feet, and is very destructive to the smaller quadrupeds. Evidence that the lynx lived in Britain during remote ages has been obtained by the discovery of a skull in Pleasley Valley, Derbyshire, corresponding with that of the lynx of Norway and Sweden. Bones ascribed to an ancient lynx have also been found in the carboniferous limestone of Teesdale, Durham. In neither case does the discovery denote any definite geological period. The skin of the male is spotted, and is more valuable in winter than in summer. Another species of lynx is the caracal, which is slightly larger than a fox. It derives its name from the black colour of its ears, *caracal* being a Turkish word signifying black. In North America there are several species of these animals, the best known of which is the northern or Canadian lynx, distinguished by the name of *loup-cervier* and *le chat* among the French Canadians. In the region round Hudson s Bay it is found in great abundance, about seven to nine thousand skins being annually exported. Although a timid creature, and incapable of attacking the larger quadrupeds, it is very destructive to rabbits and hares, on which it chiefly preys. When brought to bay by a hunter it makes but a slight resistance ; for, though it spits and erects the hair on its back like a cat, it is easily killed by a blow with a slight stick. In appearance it is clumsy and awkward, on account of its large paws, slender loins, and long but thick hind legs, with large buttocks, scarcely relieved by a short thick tail. It moves in straightforward bounds, with the back a little arched, and lighting on all four feet at once. It is not swift on land, but swims well. Its flesh is eaten, and somewhat resembles the rabbit in flavour. It breeds once a year, and has two young ones at a time. There are two other American species, both of which are smaller than the preceding ; they are named respectively *Felis rufa* and *Felis fasciata*.

LYNX.—A constellation of the northern hemisphere, formed and named by Helvetius. It is surrounded by the Camelopard, the Great Bear, Leo Minor, and the modern constellation called Herschel's Telescope. Its largest stars are of the fourth magnitude only.

LYRA, *li'-ra* (Lat., a lyre).—In Astronomy, one of the northern constellations. It is situated in the northern hemisphere, to the south of the constellation Draco, having Cygnus on one side and Herculus on the other. The name Vega is given to its largest star, which is one of the first magnitude, and situated nearly in the centre of the constellation.

LYRE BIRD, OR LYRE-TAIL, OR LYRE PHEASANT, *Menura superba*, largest of all song birds. It is found in the brush country of Southern Australia, especially New South Wales. The tail of the male is remarkably large and beautiful, and shaped like a lyre, hence the name. It is a mocking bird, adopting the songs of all it hears. It is extremely shy and difficult to approach, and seems to be disappearing in proportion as settlements spread.

LYTHRACEÆ, *li-thrai'-se-e* (from Gr., *luthron*, blood mingled with dust, because of its colour).—In Botany, the Loose-strife family, a natural order of *Dicotyledones*, sub-class *Calyciflora*. The greater number of these plants are tropical, but a few are found in the temperate regions of Europe and North America. The species *Lythrum Salicaria* is the purple loosestrife, a common British plant. This is said to be useful as an astringent in diarrhœa. The order contains 35 known genera and about 300 species. The Money-Wort is a well-known species. (*See* MONEY-WORT.)

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MACARTNEY COCK, *mak-art'-ne.*—A very handsome gallinaceous bird (*Euplocomous ignitus*), known also as the Fire-backed Pheasant. The familiar name was given because the bird was first described on the account of Lord Macartney's embassy to China in 1793. It is a native of Sumatra and other islands of the Indian Ocean. The length of the male bird is about two feet; the sides of the head are of a purplish colour, and there is a fine crest of feathers. The general colour of the bird is a deep black, with blue metallic tinges; but the middle of the back is of a rich, orange hue, and the tail is bluish, green, orange, and white. The female is smaller, without crest, and of a nearly uniform brown colour.

MACAW, *ma-kau'* (*Macrocercus*).—A bird belonging to the family *Psittacidæ*, or Parrot tribe, and distinguished from other *Scansores* (the class of the family, so named from their being climbers) by reason of their having their cheeks destitute of feathers, and their tail-feathers being very long. The macaws are natives of South America, where they were first discovered. The scarlet macaw, *M. aracanga*, is perhaps the most splendid, as well as the largest, species of the entire parrot family. Some specimens measure thirty-six inches and more from the tip of the bill to the extremity of the tail, and their plumage is a bright scarlet, relieved with different shadings of blue, yellow, and green. The great green macaw, *M. militaris*, is a native of the Andes, where it is often found at an elevation of 3,000 feet from the sea. In former times this bird used to be presented, as an inestimable gift, by the Indians to their Incas, who valued the macaw highly. It is extremely gregarious and mischievous, by reason of its predatory nature, as it commits great damage upon plantations and gardens, which it plunders right and left. The characteristics of the macaw are the same as the rest of the *Psittacidæ*, and will be found given under the article PARROT FAMILY.

MACAW TREE, GREAT.—A palm (*Acrocomia sclerocarpa*), of the same tribe with the cocoa nut. It is a native of the hot parts of America and the West Indies, and the native name is *Macoya* or *Macahuba*. The height is generally from 25 to 30 feet, and the leaves are from 10 to 15 feet long. The fruit yields a yellow, thick oil, used as a remedy for painful affections of the joints. In this country it is employed in the manufacture of some kinds of toilet soaps.

MACE, in Botany. (*See* MYRISTICA.)

MACKEREL, *mak-e-rel* (Du., *mackreel*, from Lat., *maculatus*, spotted.—A member of the *Scomberidæ*, a family of acanthopterygious fishes, and known by the scientific appellation of *Scomber scomber*. The usual length of the mackerel varies between twelve and sixteen inches; but it is occasionally found in northern seas of even greater size. The nose is pointed, and the under jaw is the longest. The colour of the back above the lateral line is a fine green, traced with rich blue, and marked with broad, dark descending lines. The sides and under surface are of a silver-colour, traced with brilliant golden tints; altogether, the mackerel is one of the most beautiful of fishes. It was supposed, originally, to be a fish of passage; but there is no doubt that this assertion is untrue, as it is caught nearly the whole year round off the Cornish coast. As an article of food the mackerel is in great request, and those taken in May and June are said to be superior to any caught later in the year. The fishery is very extensive, and the returns they bring in to the different boats engaged in the trade are something wonderful. The most common mode of fishing is by drift-nets; but the fish is also taken by line-fishing, one of the best baits being a small tapering piece of red cloth, which it eagerly bites at.

MACLE, *ma'kl.*—A mineral, known also as chiastolite. It is a silicate of alumina, containing a little magnesia and oxide of iron.

In Crystallization, Macle is a term used to describe "twin crystals," or crystals united, but not having the faces and axes parallel.

MACLURA, *mak-lu'-ra*, in honour of William Maclure, a North-American geoglist).—A genus of the natural botanical order *Moraceæ*. The wood of the species *M. tintoria*, a native of the West Indies and South America, is of a golden-yellow colour, and is much employed in this country and elsewhere as a dyeing agent. It is commonly known as *fustic*, or *old fustic*, to distinguish it from *young fustic*. (*See* RHUS.) The fruit is edible. Another species, *M. aurantiaca*, supplies the fruit called the *Osage orange*, the juice of which is used by some of the Red Indians as a yellow war-paint.

MACROPIPER, *ma-kro-pi'-per* (Gr., *makros*, long; Lat., *piper*, pepper.—A genus of the natural order *Piperaceæ*. The species *M. methysticum* is the celebrated Ava pepper-shrub, from the rhizome of which the South-Sea islanders prepare an intoxicating drink called *ava*, or *cava*. The plant has been used medicinally in chronic rheumatism and other affections.

MACROURA, *mak-rou'-ra* (Gr., *makros*, long; *oura*, tail).—A term given to the long-tailed Decapods; as, for instance, the shrimps, prawns, lobsters, &c. At the extremity of the tail there is a kind of fin, laterally expanded. This serves to propel the animal through the water by its action, which is that of a vertical stroke.

MACTRA, MACTRADÆ, *mak'-tra, mak-tra'-de.*—A genus of lamellibranchiate molluscs, sometimes known as Trough shells. The shell is nearly triangular in shape. There are many species, widely distributed. They burrow in the sand and mud of the shore and at the bottom of the sea. A large compressed foot enables them to move with activity, after the manner of cockles. The shells of some of the species are very beautiful.

MACULÆ, *mak'-u-le* (Lat., spots).—A term applied by astronomers to dark spots appearing on the luminous surfaces of the sun and moon, and even on some of the planets.

In Physiology, discolourations of the skin, resulting from some change in the production of the colouring matter.

MADDER. (*See* RUBIA.)

MADIA, *ma'-de-a.*—A genus of plants of the natural order *Compositæ*, sub-order *Corymbiferæ*. They are annuals, and valuable for the oil extracted from the seeds. This oil is nearly inodorous, of an agreeable taste, and from its capability of bearing a very low temperature without freezing, is suitable for oiling machinery. The oil-cake is good food for cattle; but the straw and chaff have poisonous properties. One species, *M. elegans*, is cultivated in flower-gardens.

MADOQUA, *mad'-o-kwa.*—A species of antelope (*Antilope saltiana*), a native of Abyssinia. It is the smallest of horned animals, being about the size of a small hare. The legs are long and slender; the horns of the male short and conical. The general colour is grey, but the fore parts are of a reddish hue.

MADREPORE, *mad'-re-pore.*—A term first employed by Imperati to designate a genus of coral-building animals, in which the calcareous axis has its whole surface beset with small lamellate and stellate depressions. Etymologically, the word is a compound of the French *madré*, spotted, and the Latin *porus*, a pore.

MAGDEBURG HEMISPHERES.—Two hollow hemispheres of copper or brass, accurately fitted to each other, and one furnished with a stop-cock. When the air is exhausted, the hemispheres are held together with immense force, so as almost to be inseparable.

MAGGOT, *mag'-got* (W., *magrod*).—A term commonly used to designate the larvæ of dipterous, hymenopterous, and some coleopterous insects. (*See* INSECT-TRANSFORMATIONS.)

MAGILUS, *maj'-i-lus.*—A genus of gasteropodus molluscs, found in the Red Sea and the Indian Ocean, and belonging to the order *Tubulibranchiata*. The mollusc has at first a shell of an ordinary spiral univalve form, and establishes itself in the little hollows of a madrepore. (*See* MADREPORE.) It enlarges the shell into a long tube as the madrepore grows, and this tube sometimes attains a length of three feet. The animal deserts the spiral part of the shell, and lives in the mouth of the tube, which it closes as a protection against danger.

MAGNESIA, *mag-ne'-she-a* (from Magnesia, a city of Lydia, near which it was originally found).—One of a group of alkaline earths, of which baryta, strontia, and lime form the other members. It is the oxide of the metal magnesium (which *see*), and is generally prepared by calcining the carbonate at a high heat, until it glows with a peculiar luminous appearance, called brightening. It is much used in pharmacy, under the name of *calcined magnesia*. For the laboratory, it may be procured in a state of purity by igniting the pure nitrate. It is a white powder, varying in density, according to the source from which it is obtained. It is unalterable by heat, and has never been fused. It slowly absorbs carbonate acid and water from the air; moistened with water, it combines with it, raising the temperature during the union, and giving rise to *hydrate of magnesia*. Crystallized hydrate of magnesia occurs in nature as the mineral brucite. It forms a white powder, which slowly absorbs carbonic acid from the air. Its water is easily expelled by heat. It is sparingly soluble in water, forming a solution exhibiting an alkaline reaction. It is used in pharmacy as an antacid and cathartic.

MAGNESITE.—In Mineralogy, native carbonate of magnesia, occurring in serpentine in compact, hard, amorphous masses.

MAGNESIUM, *mag-ne-she'-um.*—The metallic base of the alkaline earth magnesia, first obtained in small quantities by Sir Humphrey Davy, in 1808, and afterwards by Bussy, who obtained it by decomposing the chloride with potassium at a high temperature. It is a white malleable silvery metal, constant in dry air, but becoming covered with a white film of magnesia in the presence of moisture. It decomposes water at the boiling point, eliminating hydrogen. Heated to dull redness in air or oxygen, it burns with a bright light, and is converted into magnesia. A wire or ribbon of magnesia, lighted at one end, will continue to burn, and the light is so intense that it is frequently used in pyrotechnic displays and in photography. Magnesium fuses at a red heat, and may be distilled out of contact with the air. It forms only one oxide—magnesia. In many of its characters, metallic magnesium resembles zinc. It is the lightest known metal that remains constant in the air at ordinary temperatures.

MAGNET, NATURAL, *mag'-net* (from *Magnesia*, a province in Lydia, whence the Greeks obtained the loadstone).—A body endowed with magnetic polarity. The *natural magnet*, or *loadstone*, is a species of iron-ore found in various parts of the earth in irregular or crystalline fragments, and occasionally in beds of considerable thickness. Its property of attracting small pieces of iron was recognised at a very early date by the Greeks, and its wondrous directive power has been known to the inhabitants of China from time immemorial. If a piece of this magnetic iron-ore be carefully examined, it will be found that the attractive force for ferruginous particles is greatest at certain points of its surface, while elsewhere it is much diminished, or even altogether absent. These attractive points are called the *poles* of the magnet. If one of the pole surfaces of a natural loadstone be rubbed in a particular manner over a bar of hardened steel, its characteristic properties will be communicated to the bar, which will then be found to attract iron-filings like the loadstone itself. (*See* MAGNETISM AND MAGNETO-ELECTRICITY.)

MAGNETIC IRON PYRITES.—A variety of iron pyrites having magnetic properties, found in hexagonal prisms of a bronze colour.

MAGNETIC NEEDLE. (*See* COMPASS AND DIPPING NEEDLE.)

MAGNETISM, *mag'-net-izm.*—This term means, literally, the attractive and repulsive power of the loadstone; generally, that peculiar property possessed by many mineral bodies, and by the whole mass of the earth, through which, under certain circumstances, they mutually attract and repel one another, according to determinate laws. When a magnetized bar, or natural magnet, is suspended at its centre in any convenient manner, so as to be free to move in a horizontal plane, it is always found to assume a particular direction with regard to the earth, one end pointing nearly north and the other nearly south. If the magnet be moved from this position, it will tend to reassume it, and, after a few oscillations, settle at rest as before. The extremity which points towards the astronomical north is usually distinguished as the *north pole* of the magnet, and that which points southward as the *south pole*. Every magnet, whether natural or artificial, has the two poles; and as these are the points of greatest attraction, their positions can be readily ascertained by plunging the magnet into fine iron filings. A suspended bar magnet serves to exhibit certain phenomena of attraction and repulsion in the presence of a second magnet, which deserve particular attention. When a north pole is presented to a south pole, or a south pole to a north, attraction ensues between them; the ends of the bars approach each other, and, if permitted, adhere with considerable force. When, on the other hand, a north pole is brought near a second north pole, or a south pole near another south pole, mutual repulsion is observed, and the ends of the bars recede from each other as far as possible. Poles of an opposite name attract, and of a similar name repel, each other. A small bar or needle of steel, properly magnetized and suspended, and having its poles marked, thus becomes an instrument fitted not only to discover the existence of magnetic power in other bodies, but to estimate the kind of polarity affected by their different parts. A piece of soft iron brought into the neighbourhood of a magnet acquires itself magnetic properties; the intensity of the power thus conferred depends upon that of the magnet, and upon the interval which divides the two, becoming greater as that interval decreases, and greatest of all when in actual contact. The iron, under these circumstances, is said to be magnetized by *induction*, and the effect, which in an instant reaches its maximum, is at once destroyed by removing the magnet. When steel is substituted for iron, the inductive action is hardly perceptible at first, and only becomes manifest after the lapse of a certain time. The steel bar, on being removed from the magnet, does not entirely lose the induced polarity. It becomes, indeed, a permanent magnet, similar to the first, and retains its peculiar properties for an indefinite period. Magnetic attractions and repulsions are not in the slightest degree interfered with by the interposition of substances destitute of magnetic properties. Thick plates of glass, shell-lac, metals, wood, &c., may be placed between a magnet and a suspended needle, or a piece of iron under its influence, the distance being preserved, without the least perceptible alteration in its attractive power or force of induction. One kind of polarity cannot be exhibited without the other. If a magnetized bar of steel be broken at its neutral point, or in the middle, each of the broken ends acquires an opposite pole, so that both portions of the bar become perfect magnets; and if the division be carried still further, if the bar be broken into a hundred pieces, each fragment will be a complete magnet, having its own north and south poles. The direction spontaneously assumed by a suspended needle indicates that the earth itself has the properties of an enormous magnet, whose south magnetic force is concentrated in the northern hemisphere. (*See* Declination of the Needle, Dip of the Needle, Terrestrial Magnetism.) Faraday divides all bodies into two classes, calling the first *magnetic*, or better, *paramagnetic*, and the other *diamagnetic*. The matter of which a paramagnetic body consists is attracted by both poles of a powerful horse-shoe magnet; on the contrary, the matter of a diamagnetic body is repelled. When a small iron bar is hung by untwisted silk between the poles of the magnet, so that its long diameter can easily move in a horizontal plane, it arranges itself axially, that is, parallel to the straight line which joins the poles. A diamagnetic bar formed of bismuth, for instance, aranges itself equatorially, that is, at right angles to the magnetic axis.

MAGNETISM, TERRESTRIAL. (*See* Terrestrial Magnetism.)

MAGNETO-ELECTRICITY.—An important branch of electrical science which has sprung from Faraday's discovery of the development of electrical currents by the action of magnetism. If two extremities of the coil of an electro-magnet be connected with a *galvanometer* (*see* this word) and the iron temporarily magnetized by the application of a permanent steel horse-shoe magnet to the ends of the bar, a momentary current will be developed in the wire and pointed out by the movement of the galvanometer needle. It lasts but an instant, the needle returning, after a few oscillations, to a state of rest. On removing the magnet, whereby the polarity of the iron is at once destroyed, a second current or wave will become apparent, but in the opposite direction to that of the first. By employing a very powerful steel magnet, surrounding its iron keeper or armature with a very long coil of wire, and then making the armature itself rotate in front of the faces of the magnet, so that its induced polarity shall be rapidly reversed, magneto-electric currents may be produced of such intensity as to give bright sparks and powerful shocks, and exhibit all the phenomena of voltaic electricity. (*See* Electro-Magnetism.)

MAGNOLIACEÆ, *mag-no'-le-ai'-se-e*.—The Magnolia family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*. The plants of this order are remarkable for the fragrance and beauty of their flowers and foliage; hence they are favourite objects of culture in this country, either as hardy plants, as several magnolias and the tulip-tree (*Liliodendron tulipifera*), or as stove and greenhouse plants. *Magnolia grandiflora*, commonly known as the Big Lamel, is a noble evergreen tree, and has white flowers sometimes a foot in diameter. Medicinally, the plants are chiefly remarkable for their bitter, tonic, aromatic properties. The bark of *M. glauca*, the swamp-sassafras, or beaver-wood, a native of Pennsylvania, resembles cinchona in its action. The unripe fruits of other species of the typical genus, as *M. frazeri* and *acuminata*, have similar tonic and aromatic properties. *M. conspicua*, or Tulan, cultivated in China, has a profusion of beautiful and fragrant white flowers. It thrives in this country. Some of the Himalayan species, especially *M. excelsa* and *M. campbellii*, one remarkable for beauty, the latter being considered the most suberb of the genus. The majority of the order are found in North America. Some also occur in the West Indies, Japan, China, India, South America, Australia, and New Zealand.

MAGPIE, *mag'-pie*, a bird (*Pica caudata*) belonging to the family *Corvidæ*, whose generic characters are as follows:—Beak strong, compressed laterally, slightly arched and hooked at the tip; nostrils basal, covered with short stiff feathers, and directed forwards; wings short and round, the first quill-feather being very short, and the fourth or fifth the longest in the wing; tarsus longer than the middle toe; tail long and graduated. The magpie can be well distinguished as one of our handsomest native birds. The beak is black, the irides hazel; the head, neck, and upper tail-coverts jet-black; the scapulars pure white; the wing-coverts and tertials of a fine shining blue; the primaries black, with an elongate patch of pure white on the inner web of each of the first ten feathers; the tail graduated, the outside feather on each side not exceeding five inches in length, while the inner one extends eleven inches, and is of a beautiful iridescent colour; blue and purple near the end, and green from thence to the base. The chin and throat of the bird are black, the shaft of some of the feathers shining greyish-white; the upper part of the brest black, while the lower part of the same, the belly, sides, and flanks, are of a pure white colour; finally, the thighs, legs, toes, and claws, are uniformly black. The male magpie is generally eighteen inches in length, while the female is slightly smaller. It feeds on both animal and vegetable substances, destroys great numbers of grubs and slugs in pasture land, and performs a very friendly office to sheep and oxen, by getting on their backs and freeing their wool and hides from troublesome vermin. It is a social, and yet not a gregarious bird. Magpies generally continue in pairs all the year round. They build in high trees, sometimes in a lofty hedge, and occasionally in a low but thick bush, returning to the same nest for many years in succession. The nest is well constructed for security against enemies; it is of an oval shape and large, framed on the outside with sharp thorny sticks, strongly interwoven, and forming a dome over the top, the inside being plastered with mud and lined with dry grass. The magpie breeds early in spring, producing six or seven eggs of a pale bluish-white colour, spotted all over with ash-colour and two shades of greenish-brown; the length of each egg being about one inch and four lines and a half, while the breadth is about an inch. The magpie is one of the most destructive birds under the sun. No animal food comes amiss to its carnivorous appetite; young poultry, eggs, young lambs, and even weakly sheep, it will attempt to destroy by first plucking out their eyes; the young of hares, rabbits, and feathered game share the same fate; fish, carrion, insects, and fruit, and lastly grain, when nothing else can be got. It is an artful, noisy bird, proclaiming aloud any apparent danger, and thereby gives notice to its associates. Neither the fox or other wild animal can appear without being observed and hunted; even the fowler is frequently spoiled of his sport; for all other birds seem to know the alarming chatter of the magpie. It exhibits a singular propensity to carry off bright and glittering articles, and lost silver spoons have been traced to a magpie. It is easily tamed, and even learns to articulate a ew words, but it is always impudent and noisy.

MAHOGANY, *ma-hog'-an-e.*—The timber of a tall tree, *Savietenia mahogoni*, of the natural order *Cedrelaceæ*, a native of South America and the West Indies. It has small whitish or yellow flowers. The tree is of slow growth, attains a great age, and the timber is generally sound throughout. The wood varies much in value; when finely grained it is unsurpassed in beauty as a cabinet wood, and a single log, fit for cutting into veneers, has fetched as much as £1,000. The bark has an aromatic odour and an astringent, bitter taste; and is used by the natives of the places where the trees are abundant as a medicine, and in this country has been occasionally used as a substitute for Peruvian bark. The finest wood, commonly known as Spanish mahogany, comes from Cuba and St. Domingo. The Honduras or Bay mahogany is very abundant, but of inferior quality. The first knowledge of the wood in this country was obtained from the use of a piece of it in repairing one of Sir Walter Raleigh's ships at Trinidad in 1597; but, although greatly admired, there was no demand for it until at least a hundred years afterwards, when it became fashionable for furniture, and was proportionately high priced. The import is now of the value of at least half-a-million annually. The wood is hard to work, but the beauty of the surface, when highly polished, is a compensation for all difficulties. East Indian and African mahogany are the timber of trees belonging to the same natural order.

MAIDENHAIR. (*See* ADIANTUM.)

MAIGRE, *mai'-gr.*—A fish (*Sciæna aquila*) of the *Sciænidæ* family. It is sometimes six feet long, but about four feet is the average length. It is the *umbrina* of the Romans, who highly esteemed it for the table, and it is now in great request, the head being considered a special dainty. It emits a peculiar buzzing sound, which can be heard from a depth of more than a hundred feet, and guides the fishermen to the best place to let down their nets. It is common in the Mediterranean, and has been taken near the British shores. In old times, the stones of the ears were set in gold and worn on the neck, as a charm against colic.

MAIZE, *maze.*—A genus of grasses (*Zea*), the best known species of which is the common maize, or Indian corn (*Z. mays*). It was cultivated in America before the arrival of Columbus, but there is some reason to suppose that it was also grown in China and other parts of Asia at a remote period. But certainly nothing was known about it in Western Europe until 1520, when Columbus brought it to Spain. The use of it rapidly spread, and it is now extensiveiy cultivated in the south of Europe and many parts of Asia and Africa. No other cereal is so productive. If carefully irrigated, it will return four or five hundred to one in warm climates. There are many varieties, some attaining a height of from twelve to fourteen feet, some not more than three or four feet high. The grains are large, roundish, and compressed, arranged in parallel rows along the upright axis of the spike of the female flower. The ears, generally two or three in number, are situated below the middle of the stem, and are, in the larger varieties, twelve or thirteen inches long, and about three inches in diameter. The meal requires to be mixed with wheat or rye flour in the making of bread, being deficient in gluten; but it is richer than any other grain in fatty matter, and is very nutritious. In America, when coarsely ground and boiled, it is known as hominy, and the unripe grains, slightly wasted, are called popcorns. The unripe oats, too, are pickled and boiled for the table;

and a kind of beer, a spirituous liquor, and vinegar are also obtained from maize. The starch, under the name of Oswego flour, is used both in America and this country as a substitute for arrowroot. Other uses of maize are very numerous. The pith of the culm, before the flowers are produced, yields a sweet juice, which is made into syrup, and also fermented and distilled. In Mexico the young stalks are eaten as dessert; it also affords food for poultry and fodder for cattle. The stalks are useful for making baskets and thatching huts; the fibres are worked up into a strong yarn, and the bracts which surround the ear make good stuffing for chairs and mattresses, and are also employed in paper-making. A small species (*Z. Curagua*), known as Chili maize or Valparaiso corn, is regarded with superstitious veneration, because, when roasted, the grains split in the form of a cross.

MAJORANA, *maj-o-rai'-na* (said to be a corruption of the Arab. *maryamych*).—A genus of the natural order *Labiatæ*. The species *M. hortensis* is the sweet marjoram of the gardens. (*See* MARJORAM.)

MALACHITE, *mal'-a-kite* (Gr., *malache*, the green mallow flower).—A mineral found in Siberia, South Australia, and other parts of the world, in concretionary masses consisting of carbonate of copper. When cut and polished, it shows its structure in series of concentric circular markings of different shades of green, corresponding to the concretions. It is much admired as an ornamental stone for inlaying purposes, the fitting together of the circular markings affording much scope for artistic treatment. Large slates of it are made into tables, mantelpieces, and even into doors, of great beauty. The amorphous and less regular masses form an important ore of copper. Small quantities of malachite have been found in Cornwall and Wicklow.

MALACOLOGY, *mal-a-kol'-o-je* (Gr., *malakos*, soft, and *logos*, a discourse).—A name applied by some naturalists to the study of the animals of the class of shell-bearing molluscs, which will be found treated under MOLLUSCA.

MALACOPTERYGIANS, *mal-a-kop-ter-ij'-e-anz* (Gr., *malakos*, soft; *pterugion*, fin).—A term applied in Ichthyology to such fishes as have the rays of their fins bony, although not pointed or sharp at the extremities like those of the class termed acanthopterygious fishes.

MALAMBO BARK. (*See* CROTON.)

MALAPTERURUS, *mal-ap-te-ru'-rus* (Gr., *malakos*, soft; *pteron*, a fin; *oura*, a tail. A genus of fishes of the family *Siluridæ*, in which a soft fin near the tail takes the place of the true dorsal fin.

MALARIA, AND MIASM, *mal-ai'-re-a*, *me'-azm* (Ital., *mala aria*, bad air, and Gr., *miaino*, I infect).—The former of these words is now generally employed to designate a certain effluvium or emanation from marshy ground; and the latter, with the adjunct of marsh, is used in the same sense. This poison is not cognizable by the senses, nor can it be detected by chemical tests; it is known only by its effects upon, the system. Marshes, whether salt or fresh are prolific sources of malaria, especially in a certain stage of the drying process under a hot sun. But this poison is the product also of various sorts of soil; as wet meadows, grounds alternately flooded and drained, the mud left by the retiring tide in seaports and estuaries, parts covered with low and dense brushwood or with reeds and grass, a country newly cleared of its wood,—all these, particularly in warm climates, are fertile sources of malaria. The concurrence of vegetable matter susceptible of decay, of moisture, either on the surface or a short distance below it, and of a certain elevation of temperature, is necessary for its evolution; and of these long-continued heat has the greatest influence in increasing the intensity of the poison. Comparatively harmless in the northern parts of the temperate zone, it becomes malignant and deadly in places equally favourable to its production, just in proportion to the increase in the mean annual temperature. It is not necessary that the amount of vegetable matter be great, or its growth recent, since malarious diseases are often caused by the drainage of ponds and lakes; neither is the quantity of water required to be large for the generation of malaria. In tropical countries it is remarked that the evolution of malaria commences immediately on the falling of the rain, and the sickness abates as the ground gets thoroughly wetted. A marsh completely covered with water is innocuous; it is only when the moisture is being dried up under a hot sun that it becomes pestilential. In the case of inundations, it is at their subsidence that sickness prevails. Heat is the agent most active in the production of malaria in all soils and situations capable of engendering it; hence, in this country, even the milder forms of malarious disease are rarely seen before the vernal or after the autumnal equinox; and wherever they exist, their prevalence is terminated by the cold of winter. The distance to which marshy emanations may extend by gradual diffusion has been calculated to be 1,400 to 1,600 feet in elevation, and from 600 to 1,000 feet in a horizontal direction; and these limits, it is said, cannot be exceeded in Europe; but in equatorial regions the activity of the poison is greater; and in the West Indies, vessels 9,000 feet from the marshy coast have felt the effects of its baneful influence. But when winds are in operation, the extent to which the poison may be transported is unknown; but instances are recorded of its being conveyed three or more miles. Though malaria is principally owing to heat, it is not in the hottest part of the day that its influence is most pernicious, but in the evening or night. Besides the more familiar effects of malaria—intermittent and remittent fevers, there are a number of organic affections of the spleen, liver, stomach, intestines, and mesenteric glands, also dropsy, apoplexy, palsy, and idiocy, that are traced to its long-continued application; while cholera, dysentery, and diarrhœa, are referred to its more brief agency. Nutritious diet, and whatever is most conducive to health, should be observed by persons exposed to the influence of malaria.

MALESHERBIACEÆ, *malz-hairb-e-ai'-se-e* (in honour of Lamoignon de Malesherbes, a French patriot and agriculturist).—The Crownwort family, a small natural order of *Dicotyledons*, sub-class *Calyciflorœ*, consisting of herbaceous or somewhat shrubby plants, resembling *Passifloraceæ;* but differing in never being climbers, in the want of stipules, and in some other minor characters. There are but two genera, *Malesherbia* and *Gynopleura*, which include five species, all natives of Chili and Peru.

MALIC ACID, *mai'-lik* (Lat., *malum*, an apple).—A vegetable acid found abundantly in most acidulous fruits, especially in unripe apples, gooseberries, and currants. The footstalks of the ordinary garden rhubarb also furnish large quantities of it; but it is most usually obtained from the berries of the mountain ash. The only use to which malic acid has yet been applied is in the manufacture of succinic acid by the fermentation of neutral malate of lime.

MALIGNANT-PUSTULE, *ma-lig'-nant pus'-tule.*—A contagious and fatal disease, common in France, but rare in this country. A pustule appears on the skin, and when opened sloughing spreads rapidly, and symptoms similar to those of putrid typhus fever appear. It is caused by infection from horse and cattle, and is supposed to be communicated to human beings by flies which have alighted on the ulcers of diseased animals. The application of nitrate of silver and a very nourishing diet are the remedial measures.

MALLEACEÆ, *mal-le-a'-se-e.*—A family of lamellibranchiate molluscs, the typical genus of which, *Malleus*, is commonly known as the Hammer Shell. All the species are natives of the tropical regions of the Indian Ocean, the Western Atlantic, and the South Seas.

MALLEUS, *mal'-le-us.*—A term applied to one of the bones of the ear, from its resemblance to a mallet. (*See* EAR.)

MALLOW. (*See* MARSH-MALLOW.)

MALPIGHIACEÆ, *mal-pig-e-ai'-se-e* (in honour of Marcello Malpighi, an Italian naturalist).—The *Malpighia* family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*. The plants of this order are trees or shrubs, and some of them are climbers, and confined to tropical climates. Some have edible fruits, as the species *Malpighia glabra* and *punicifolia*, which yield the Barbadoes cherries; others are chiefly remarkable for their large and showy flowers; while some are interesting to the botanist on account of their anomalous stems, the peculiarity of which consists in the presence of several woody axes without annual zones. The order is generally characterized by astringency. There are about 600 known species.

MALTESE TERRIER. (*See* TERRIER.)

MALVA, *mal'-va* (Lat.), the Mallow, the typical genus or the natural order *Malvaceæ*. (*See* MARSH MALLOWS.)

MAMMALIA, *mam-mai'-le-a* (from Lat., *mammæ*, the breasts).—This important class in Zoology, the highest of the vertebrated series in the animal kingdom, includes all such animals as bring forth their young alive, and are provided with organs for suckling their young. Even excluding man, who necessarily belongs to the class, we find amongst the *mammalia* the greatest number of faculties, the most delicate sensations, the most varied action, and an extraordinary aggregate of properties for the production of intelligence. All mammalia are endowed with warm blood, which results from the great development of their respiratory apparatus, the heart being double, and containing four cavities—that is to say, an auricle and ventricle on the right side, and the same on the left. The circulation is carried on in the following manner:—The venous blood passes through the cavities on the right side and is distributed through the lungs, where it combines with the oxygen or vivifying portion of the air; it is then conveyed by the pulmonary veins to the left auricle, from whence it flows into the ventricle, and is propelled through the arterial system. (*See* HEART.) The females suckle their young with milk secreted in breasts or *mammæ*, and are viviparous; they are consequently placental or implacental—the placental including the higher order of mammals, from man to the last true rodent, and the implacental composing the marsupialia and monotremata. Both of these divisions have the upper jaw fixed to the skull, and the lower is formed of but two pieces only, and is articulated to the temporal bone. The neck is composed (except in a very few members of the class) of seven vertebræ. The anterior extremities of these commence with a shoulder-blade which is not articulated, but rests between the muscles, and often, indeed, leans on the sternum by means of the clavicle on each side. This is continued by an arm, forearm, and hand. The latter is formed of two rows of bones, called the *carpus*, a third row, called the *metacarpus*, and fingers, each consisting of two or three joints. With the exception of the cetacea, or whale family, all mammalia have the pelvis attached to the spine, the pubes forming the anterior, and the ilia, ischia, sacrum, and coccyx the lateral or posterior parts. At the point where the first three mentioned bones unite, on each side, is the articulation of the femur, or thigh-bone, to which are attached the leg-bones, tibia, and fibula, which are in most cases distinct, and are succeeded by those composing the foot, which correspond to the bones of the hand—namely, a tarsus, metatarsus, and toes. In different orders and genera of animals the extremities vary considerably; in some those of the fore parts are considerably lengthened, so as to form the supporters of a wing, as in bats; in others they are shortened, as is evinced in the jerboa and kangaroo; while in both of these last-mentioned varieties the posterior extremities are enlarged in the apparently greatest disproportion. The cetacea and similar animals, which have been briefly alluded to, have no pelvis whatever; their hinder extremities are likewise wanting; they are, however, supplied, instead of these, at the end of the spine or vertebral column, with cartilaginous bodies forming a kind of feet, or the flukes of the tail, which, in this species, is always horizontally placed. The fore-foot (*metatarsus*) usually counts as many bones as there are toes present. The metatarsus in the ruminant and solidungulate animals is conformable to the metacarpus. In the genus *Dipus* (the jerboa), amongst the rodents, the three middle metatarsal bones unite so as to form a single bone, which terminates below in three processes, to which the three large toes are connected, and which thus resembles the principal bone at the root of the foot in birds. The digits of the foot in the ruminants, the solid ungulates, and commonly, also, in the pachyderms, correspond in number and form to those of the hand. Such, also, is the case in most of the carnivorous animals, although in the genera *Felis* and *Canis* the thumb (*pollex*) of the hind foot is not developed, and a trace only is observed in the fore-foot. In the monkeys the thumb is shorter; but the other digits are longer than in the human foot. The head is, in all mammalia, articulated by two condyles upon their atlas or first vertebra: as the seat of intelligence, it has excited the greatest interest in all ages, and it has been remarked that the approach to reason observed in animals bore some relation to the size and configuration of the head. The brain is the centre or origin of the nervous system. (*See* BRAIN, EAR, and EYE.) The tongue of mammals is always fleshy, and is attached to a bone termed the *os hyoides*, which is composed of several pieces, and suspended to the cranium by ligaments. The lungs are two in number, and are divided into lobes, which are composed of an immense quantity of small cells: they are suspended without adhesion in a cavity formed by the ribs and diaphragm, and lined by the pleura. The skin of the greater number of mammals is covered with hair, a peculiar characteristic of the class; and the nails, claws, hoofs, and horns are all composed of a substance which is only a modification of hair. Some exceptions, however, have horny plates, as the tribe *Manis*, or bony plates, as the armadilloes (the genus *Dasypus*); and, indeed, some have spines. The sense of touch is variously developed in the extremities of the limbs in the different species, according as the feet move only for progression, for standing, or for seizing alone. In the apes, which appear to be in this respect one of the most privileged, the hand is much less adapted for feeling than in man, who, in his erect position, can move and apply his fore limbs for the sense of touch more easily. The whiskers which are attached to the lips of some animals serve also, like the fleshy appendages attached to the jaws of some fishes, to give warning of external obstacles, on account of branches from the fifth pair of nerves being attached to their roots. The motions of mammals consist principally in progressing. Some are able to spring to great heights; others, again, are formed for swimming. In the cetaceans, or whales, swimming is the sole means of motion. Other mammals are able to fly by means of a membranous substance below the elongated fingers of the four limbs, like the bats, for instance.

Distribution of the Mammalia.—Some of this class of animals reside entirely in the sea, as the cetaceans and most of the seals. (*See* SEAL FAMILY.) Although some species, especially of the animals last named, live in fresh water, many varieties of the genus *Sorex*, the otters, beavers, and the duck-mole, reside in lakes and rivers. Others, again, live under ground, as the family *Talpa* and *Bathyergus*. The greater part, however, live on land—some on high mountain-tops; as the antelope, ibex, &c.; others on trees, as the apes, squirrels, and monkeys; and some resort, by flying and flapping in part, even to the air (the *Galeopithecus* and *Cheiroptera*). This difference of resort is naturally in relation with the general bodily form of the animal, and the constitution of its various parts, especially of the organs of motion and sense. In the geographic distribution of the mammalia, it may be stated that the numbers of its various classes increase from the pole to the equator,—as well the various classes as the sub-genera; although the cetaceans and seals must be excepted from the rule. There are species in the north polar regions common to the Old and New World. In the temperate parts of North America, almost all the species are such as do not appear in the eastern hemisphere; while in South America no single species is found which also lives in the Old World; even the genera differ, for the most part, from those of the Old World. Other genera are peculiar to the eastern hemisphere. Most of the species of antelopes are exclusively African. Most of the *Marsupial* species are found in Australia and the adjoining islands; while the genus *Didelphys* alone is American,—Africa, as well as Europe, not possessing a single species of this division. If we take into consideration the entire class of mammals, exclusive of the *Cetaceans* and *Phocæ*, then the *Rodents* will be found to form one-third of the entire number of species, the *Carnivores* and *Cheiropters* together about one-third also, while the remaining third is formed, for the greater part, of the Quadrumanes and Ruminants; and especially of the Marsupials and insectivorous *feræ*. With the exception of some species of bats and of the true whales, Mammals are not tied, like birds of passage, to make strictly limited migrations; but inhabit the same districts both in winter and summer. On the other hand, different species hybernate, and pass a greater or less portion of the year without food in caves and hiding-places. Amongst such in Europe are, for example, the bat, the hedgehog, the hamster, the marmot, and various other species of rodents, forming the genus *Myoxus*; and in the north the bears. (*See* HYBERNATION.)

Classification of the Mammalia.—With reference to the classification and division of animals of the section *Mammalia*, that proposed by Cuvier is, with some variations, generally adopted. Cuvier's arrangement is as follows (*see* several headings):—

Class MAMMIFERES.

Order. I. BIMANA.—Man.

Order II. QUADRUMANA:—Two families.—1. Apes and monkeys; and 2. *Macaucos* (*Lemur*, according to Linnæus).

Order III. CARNASSIERS:—Family 1. *Cheiroptera* (Bats).—2. *Insectivora* (Hedgehogs, Tenrecs, *Tupaia*. Shrews, *Mygale*, *Chrysochloris*, *Talpa*, *Condylura*, *Scalops*).—3. *Carnivora*. Tribe 1. *Plantigrades*: Bears, Raccoons (*Procyon*), *Panda*, *Benturongs*, Coatis (*Nasua*, Storr.), Kinkajous, Badgers, Gluttons, Ratels. Tribe 2. *Digitrigades*: Martens, Skunks, Otters, Dogs, Civits, Genets, *Paradoxurus*, *Ichneumons*, (*Herpestes*, Illiger), Suricates, *Crossarchus*, *Proteles*. The last subdivision of the Digitigrades is composed of the Hyænas and the Cats, in which last the sanguinary development is at its height. Tribe 3. *Amphibia*: the Seals (*Phocæ*, Linn.), and the Walruses (*Trichecus*, Linn.).

Order IV. MARSUPIALIA.—Subdivision 1. Opossums, Dasyurus, *Perameles*. Subdivision 2. *Phalangista*. Subdivision 3. The Kangaroo Rats (*Hypsiprimnus*, Illiger), the Kangaroos, the Koalas, and the *Phascolomys*.

Order V. RODENTIA.—The Squirrels (*Pteromys* and *Cheiromys*, Cuvier), *Echimys*, *Hydromys*, Capromys, the Rats proper, the Jerbilles, *Meriones*, the Hamsters, *Cricetus*, and the *Arvicola*, the Rats, the Souslik, *Myoxus*. Also the Field Mice and Rats, the Lemmings, the Jerboas (*Dipus*), the Beavers, the Porcupines, the Hares (*Lepus*, Linn., including the *Lagomys* of Cuvier), the *Capybara*, the Guinea-pigs, the Agoutis (*Chloronys*), the Pacas, and the Chinchillas.

Order VI. EDENTATA.—Tribe 1. *Tardigrades*: the Sloths (*Bradypus*, Linn.) Tribe 2. Ordinary *Edentata*: the Armadilloes *Dasypus*, Linn.), and the sub-genus *Chlamyphorus*, the Ard-Vark and the Ant-eaters, the Pangolins (*Manis*, Linn.) Tribe 3. The Monotremes, the *Echidna*, and the *Ornithorhynchus* (*Platypus*, Shaw).

Order VII. PACHYDERMATA.—Family 1. Proboscidians: Elephants and Mastodons. Family 2. Ordinary *Pachydermata*: the Hippopotamus, the Hogs, the Rhinoceroses, the Damans (*Hyrax*), and the Tapirs. Family 3. *Solipeda*: the Horses, &c., (*Equus*, Linn.)

Order VIII. RUMINANTIA.—1. No horns: the Camels, including the Lamas, and the Musks. 2. True horns, shed periodically: the Stags or Deer (*Cervus*, Linn.) 3. Persistent horns: the Giraffe. 4. Hollow horns: the Antelopes, the Goats, the Sheep, and the Oxen.

Order IX. CETACEA.—Family 1. Herbivorous *Cetacea*: the Manatees, the *Eugongs*, and the Rytina (Illiger). Family 2. Ordinary *Cetacea*: the Dolphins and the Porpoises, the Narwhals (*Monodon*, Linn.), the Cachalots, and, finally, the Whalebone Whales (the *Balæna* of Linnæus, including the *Balænoptera* of Lacépède).

Number of Species of Mammals.—About 2070 are known to exist, of which about 150 are found in Europe, 240 in Africa, 350 in Asia, 401 in America, and from 60 to 70 in Australia.

MAMMAL GLAND. (*See* BREAST.)

MAMMEA, *mam-me'-a* (*mamey* is the original name of the species).—A genus of the natural order *Guttiferæ*. The species *M. Americana* produces the fruit called the mammee apple, or wild apricot of South America, which has a most delicious flavour. From the flowers a kind of brandy is distilled, and the sap when fermented forms a wine. The seeds are anthelmintic.

MAMMOTH, *mam'-moth* (Tartar, *mamma*, earth).—The name given to an extinct species of elephant (*Elephas primigenius*), the bones of which resemble those of the existing Asiatic species, but whose grinders have the ribands of enamel narrower and straighter, the alveoli of the tusks longer in proportion, and the lower jaw more obtuse. The mammoth was thickly covered with hair of three different kinds; one consisting of stiff black bristles a foot in length; another of coarse flexible hair; and the third of a kind of wool. The bones and tusks of the mammoth are found throughout Russia, and more particularly in Eastern Siberia and the Arctic marshes, &c. The tusks form an article of commerce, and are much used in making the inferior kinds of ivory goods. In Siberia, during 1799, a whole mammoth was discovered by a Tungusian, with all the soft parts preserved in the snow. The entire carcass was 9 feet 4 inches high; 16 feet 4 inches long, from the point of the nose to the end of the tail, without including the tusks, which were 9 feet 6 inches, measuring along the curve. The two tusks together weighed 360 lb. avoirdupois, and the head, with the tusks, 414 lb. Remains of the *Elephas primigenius* have been found in large quantities in the British isles. The mammoth became extinct at the close of the Pleistocene period. (*See* GEOLOGY.)

MAN, *man* (Ger., *mann*; Fr., *homme*; Lat., *homo*; Gr., *anthropos*).—The highest and noblest of all created beings that inhabit this earth—incontestibly the lord of the creation. Considered as an object of natural history, man is a mammiferous animal belonging to the order *Bimana*, or two-handed, of which he constitutes the sole genus, *Homo*. (*See* MAMMALIA.) The distinguishing characteristics of man are two hands, the erect posture, teeth approximated and of equal length, the inferior incisors perpendicular, prominent chin, rational, endowed with speech, unarmed, defenceless. That which constitutes the *hand*, properly so called, is the faculty of opposing the thumb to the other fingers, so as to seize upon the most minute objects; a faculty which is carried to its highest degree of perfection in man. The next series of characters are those by which he is by nature adapted to the erect posture, the head nicely balanced on the summit of the vertebral column, and the muscles of the trunk and limbs, which contribute to the maintenance of the erect posture, largely developed. The face is placed immediately beneath the brain, so that its front is nearly in the same plane as the forehead, which is peculiarly characteristic of man. The vertebral column in man has its curves so arranged that when the body is in an erect posture a vertical line from its summit would fall exactly on the centre of its base; and it increases considerably in size in the lumbar region. The lower extremities in man are remarkable for their length, which is proportionally greater than in any other mammal except the kangaroo. The human foot is, in proportion to the size of the body, larger, broader, and stronger than that of any other mammal save the kangaroo; and hence man alone has the power of standing upon one foot. The brain of man does not differ so much in conformation from that of the higher mammals, as the superiority of his mental endowments might have led us to anticipate; but the greater relative size of the brain-case and brain is remarkable. (*See* BRAIN.) The absence of any natural weapons of offence and of direct means of defence are remarkable characteristics of man, and distinguish him from even the most anthropoid of apes, whose enormous canines have no relation to a carnivorous regimen, but are instruments of warfare. The slow growth of man, and the length of time during which he remains in a state of dependence, are also peculiar to him. He also possesses, in a remarkable degree, the power of adaptation to varieties in external condition which renders him in a great measure independent of them. He is capable of sustaining the highest as well as the lowest extremes of temperature and of atmospheric pressure, and of subsisting on a great variety of food. But most of all is man distinguished from other animals by those mental endowments, and by the habitudes of life and action thence resulting, which must be regarded as the essential characteristics of humanity. It is in adapting himself to the conditions of his existence, in providing himself with food, shelter, weapons of attack and defence, &c., that his intellectual powers are first called into active operation; and when thus aroused, their development has no assignable limit. The capacity for intellectual progress is one of the most remarkable peculiarities of man's physical nature. The power of articulate speech, as a means of communication, is peculiar to man, although some birds, by the force of imitation, acquire the power of uttering words and short phrases. But the mainspring of human progress may be said to lie in that aspiration after something nobler and purer which is peculiar to the human race, and which is connected with another element in his nature which it is difficult to isolate or define, but which enters, penetrates, and blends with his whole physical character. It is the soul, as Dr. Carpenter observes, in whatever way we may define it, which seems to constitute the distinctive peculiarity of man.

Antiquity of Man.—Some geologists suppose, from the discovery of human bones and of flint implements (*see* CELTS), evidently the work of human hands, in certain strata, that man was a contemporary of the cave bear and mammoth; but scientific opinion on this subject is not unanimous.

MANACA, *man'-a-ka*.—A plant (*Franciscœa uniflora*) of the natural order *Scrophulariaceæ*. The plant, especially the root, is used medicinally in Brazil, of which it is a native, as a purgative and emetic, and especially as a remedy for syphilis. It is intensely bitter, and an overdose is poisonous.

MANATIDÆ, *man-a-ti'-dæ*, (Lat., *manus*, a hand.)—A family including all the herbivorous sections of the order *Cetacea*, which differ from the other sections as having swimming paws instead of pectoral fins. One genus, the Manatee, has small, flat nails at the edge of the paws, and fingers can be felt. It is found on tropical coasts, living chiefly in shallow bays and creeks, and frequently ascending rivers to a considerable distance, feeding on algæ, and plants which grow along the shore. The best known species, *M. Americanus*, abundant in the tropical seas of the West Indies and Central America, is in some cases 20 feet long, and weighs nearly four tons. Manatees are generally found in herds, and exhibit great attachment to each other. When attacked, the young animals are placed in the centre, and if one of the herd is struck with a harpoon, others try to pull the weapon out. They are commonly known as sea-cows, and the flesh is much liked. It has been suggested that the legends of the appearance of mermaids may have originated in the appearance of small female manatees, with the heads and breasts raised out of the water. The Dugong and Stellerine (*see* those headings) belong to the family).

MANCHINEEL, in Botany (*See* HIPPOMANE.)

MANDIBLES, *man'-de-bls* (from Lat., *mando*, I chew).—The upper and lower parts of the beak in birds. In Entomology, the upper and under pairs of jaws. Insects having mandibles are classed as *Mandibulata*, or masticating insects.

MANDRAGORA, *man-dra-go'-ra* (Lat., *mandragorus*).—A genus of the natural order *Atropaceæ*. *M. officinalis* is the true mandrake, the devil's apple of the Arabs, and the root referred to in the 30th chapter of the book of Genesis. Its root has a fancied resemblance to the human form, and is connected with many absurd superstitions. It must not be confounded with the root of *Bryonia dioica*, which is often called mandrake. The mandrake is an acro-narcotic poison, and before the discovery of chloroform was sometimes administered to produce insensibility during surgical operations. It was used by the ancients as an anæsthetic, and also as an aphrodisiac.

MANGANESE, *man-ga-neeze'*.—The ores of manganese are somewhat abundantly distributed throughout the mineral kingdom, generally in the form of black oxide. Manganese is of a greyish-white colour, brittle, hard enough to scratch steel, can only be fused at a white heat, and is slightly magnetic. If exposed to the air it speedily becomes oxidized. It occurs in small quantities in association with iron in meteoric stones; otherwise it is not found native, and the metal is obtained by the reduction of its sesquioxide by carbon at an extreme heat. The specific gravity is 8·073, the atomic weight 55, and the symbol Mn. Manganese combines with carbon and silica, forming unimportant compounds. Its principal use is chemical, under the form of oxide. It is employed in this state for decomposing hydrochloric acid, in the manufacture of chlorine, as a cheap source of oxygen, and as a colouring material in the manufacture of glass and enamels. Mixed with iron, it gives that metal increased hardness and elasticity: hence its use in the manufacture of steel.

Ores of Manganese.—The principal ores of manganese are *pyrolusite*, the anhydrous binoxide, and black wad, which is the hydrated binoxide. Both these ores are worked extensively in different parts of the world.

MANGEL-WURZEL, OR MANGOLD-WURZEL. (*See* BETA.)

MANGIFERA, *man-jif'-e-ra* (from *mango*, and Lat., *fero*, I bear).—A genus of the natural order *Anacardiaceæ*. *M. Indica* produces the mango, a fruit which is highly esteemed in tropical countries. This fruit is a drupe, large, flattened like a lens, and kidney-shaped. When ripe, it is yellow or reddish, with soft and pulpy flesh, filled with juice. It is a favourite for dessert, having a luscious and sweet flavour, with a slight acidity. Several varieties of the mango-tree are cultivated, which yield fruits differing greatly in size and flavour. Unripe mangoes are used for making the pickle called *chutney*.

MANGO. (*See* MANGIFERA.)

MANGO-FISH, *mang'-go*.—A genus (*Polynemus Risua*) usually termed the *Polynemus*, and belonging to the family *Polynemidæ*. The ventral fins are inserted further back than the pectorals. The mango-fish, so named from its yellow colour resembling that of a ripe mango, is further distinguished by having several long filaments beneath the pectoral fin, which filaments are, in fact, free rays of that fin. The teeth are very minute and dense in quantity, and are recurved, like the teeth of a carding-machine. The form of the body generally resembles that of the perch, with the peculiar exceptions mentioned above; the muzzle projects over the mouth; the eyes are large, and placed very forward; and, finally, the dorsal fins are short and widely separated, while the caudal fin is large and more or less forked. The mango-fish, which is eight or nine inches in length, is esteemed a great delicacy in India, and it is found principally in Channel Creek, off Saugor, and in and about the mouths of the rivers which intersect the Sunderbunds. It is known locally as Bartah or Tupsee. Great interest is attached to it from the fact of its yielding isinglass. Several other varieties of the mango-fish are found in the warm latitudes of Africa and America, and nearly all bear a close resemblance to the type which has just been described.

MANGOSTEEN, *man'-go-steen*.—The fruit (*Garcinia mangostana*) of a tree of the natural order *Guttiferæ*, a native of the Moluccas, but cultivated in other tropical countries. The fruit bears a general resemblance to an orange, has a most delicious flavour, and is considered to be beneficial in cases of fever. The tree rarely exceeds 20 feet in height, and is very graceful in appearance.

MANGROVE. (*See* RHIZOPHORA and AVICENNIA.)

MANIA. (*See* INSANITY.)

MANIOC, OR MANDIOC, *man'-i-oc*.—The Cassava, a large, half-shrubby plant, a genus of the natural order *Euphorbiaceæ*. The species *M. utilissima*, the bitter cassava, is an important food-producing plant. Cassava-meal, which is largely employed in the making of the cassiva bread or cakes in common use among the inhabitants of tropical America, is obtained by grating the washed roots and then subjecting the pulp to pressure and heat. The roots and expressed juice are virulent poisons, owing chiefly to the presence of hydrocyanic acid; but their poisonous qualities are removed by the washing and heating. Cassava-starch, tapioca-meal or Brazilian arrowroot, and tapioca, are likewise prepared from the roots. The starch is deposited from the expressed juice, and is purified by washing with water. Tapioca is prepared by heating this starch, while moist, on hot plates: it is largely employed in Britain and elsewhere as dietical substance. (*See* TAPIOCA.) The sauce called *casareep* in the West Indies is the juice concentrated by heat and flavoured with aromatics. The species *M. Aipi*, the sweet cassava, has none of the poisonous properties of the former species. Its root is a common article of food in the West Indies and some parts of South America, and is said to be cultivated in some parts of Africa. It is as mealy as the potato when boiled. The produce of the manioc is at least six times that of wheat.

MANIS, *ma'-nis.*—A genus of mammalia, of the order *Edentata*, having a general resemblance to the ant-eaters, but differing in having the body and tail covered with large, sharp-edged, and pointed scales. They are natives of Africa and the hotter parts of Asia. There are many species. One (*M. tetra dactyla*), remarkable for great length of tail, a native of Western Africa, is the *Phattagen* of the ancient writers. The body is about two feet long and the tail three feet.

MANNA, *man'-na.*—A sweet juice obtained principally from the mountain ash. (*See* ASH.) It is obtained by making incisions in the bark in July and August, and hardens in masses or flakes, forming a porous substance of a yellowish colour. As a medicine it has a gentle purgative effect, and is generally administered to very young children. The common larch and one species of the Australian eucalyptus (*E. mannifera*) also yield manna.

Mannite, or Mushroom Sugar.—The saccharine matter of manna, found also in several kinds of fungi, asparagus, celery, and onions. If manna is digested in hot alcohol, the mannite is deposited in crystals, soluble in water, and of a sweet taste.

MAN-OF-WAR BIRD. (*See* FRIGATE-BIRD.)

MANTELLIA, *man-tel'-le-a.*—In Geology, fossil cycadeoidea of the Isle of Portland, named in honour of Dr. Mantell.

MANTIDÆ, *man'-ti-de.* (*See* MANTIS.)

MANTIS, *man'-tis.*—A genus of orthopterous insects of the family *mantidæ*, noticeable for their strange forms. (*See* LEAF INSECTS, SPECTRE INSECTS, WALKING-STICK INSECTS.) The mantis has an elongated and compressed abdomen, a triangular head, large eyes, and long antennæ. The first pair of legs are used to seize food and for fighting, it being a most quarrelsome insect. The other legs are long and slender. It feeds on other insects, and will watch its prey for a long period, moving the fore-legs in the air with a peculiar action, which has made them objects of superstition among the peasantry of southern Europe, who speak of them as "praying insects." Some of the South American species are four inches in length. In some parts of eastern Asia these insects are kept in cages, and set to fight for the amusement of the spectators.

MAPLE, *ma'-pel.*—A genus (*Acer*) of exogenoustres of the natural order *Aceraceæ*. It is very abundant in North America and the north of India. The Common Maple (*A. campestre*) is a small tree, native of many parts of Europe and Asia. The Greater Maple, or Sycamore, sometimes known also as the Plane-tree, is tall, with a spreading head; the wood is fine and white, and much used by turners and wheelwrights. The sugar-maple (*A. saccharinum*) of North America, is a large tree resembling the sycamore, but with a slenderer trunk. The sap is obtained by boring holes, and when boiled and strained a coarse sugar is obtained. The timber is used for cabinet-making; the "bird's eye" grain well adapting it for veneers.

MAQUI, *mak'-we.* — An evergreen shrub (*Aristotelia Maqui*) of considerable size, a native of Chili. The Chilians make wine from the berry, and the wood and bark are used for the body and strings of musical instruments.

MARABOU, *mar'-a-boo* (*marabou*, the native African name).—The popular name of several large birds belonging to the Stork family, included in the genus *Leptoptilus* of Lesson. The birds are natives of Africa and Asia. The Asiatic variety of marabou, called the Adjutant, has no equal in size, except the ostrich. The feathers of this bird command a high price as articles of personal adornment. They are principally used for ladies' head-dresses, and are as light as they are graceful. A smaller species, the *Leptoptilus Marabou* of Temminck, occurs in tropical Africa, assisting the vultures in consuming the filth of the negro villages. Its appearance is even less prepossessing than that of the Asiatic bird, though its plumes are equally valued.

MARANTA, *ma-ran'-ta* (after Maranti, a Venetian physician and botanist).—The typical genus of the natural order *Marantaceæ*. The species *M. arundinaccea* yields West-Indian arrowroot, one of the most pure and best-known of the amylaceous substances used as food.

MARANTACEÆ, *mar-an-tai'-se-e.*—The *Maranta* or Arrowroot family, a natural order of *Monocotyledones*, sub-class *Petaloideæ*, consisting of herbaceous plants. There are 7 genera and 160 species, all natives of tropical regions. The rhizomes of some species contain starch, which, when extracted, is extensively used as food. (*See* CANNA and MARANTA.)

MARASMUS, *ma-ras'-mus* (Gr., emaciation).—A term often used by old writers to denote a wasting of the body for which no cause could be discovered. (*See* MESENTERY.)

MARBLE, *mar'-bl* (Fr., *marbre*).—A term applied by mineralogists to limestones, white or coloured, capable of receiving a polish. In the ordinary language of the mason it means almost any rock which may be polished, such as steatite, serpentine, breccia, &c. The use of marble for ornamental and artistic purposes dates from the remotest antiquity. Italy is the principal marble-producing country of the world; the far-famed quarries of Carrara having supplied statuaries with this beautiful material from time immemorial. The principal quarries of the district are at Carrara, Massa, and Seravezza, and produce between forty and fifty thousand tons per annum of white and coloured marbles. La Spezzia, Moriti, Pisani, Campiglia, Elba, Sienna, and Gerfalco, also produce marble of great excellence and beauty, but in comparatively small quantities. The principal Italian marbles are *Carrara* (often miscalled Sicilian), pure white; *Giallo antico*, yellow, more or less veined; *Rosso antico*, blood-red, and speckled with white; *Portoro*, black, with gold rings and veins; *Bardiglio*, dove-coloured and veined; *Lamachello*, dark brown, with iridescent particles; *Cipalin*, white, with green rings and veins; *Mandeluto*, red, with yellow spots; *Brocatello di Siena*, yellow, with purple spots; and *Verde antico*, clouded green. Parian marble occurs in the island of Paros, and is almost as celebrated as that from Carrara. The principal marbles found in Great Britain are the Kilkenny and Connemara, black and green marbles; Bristol, Sussex, and Derbyshire marbles, containing shells; the encrinital marbles of Derbyshire; the Cornwall, serpentine, and steatite; and the Devonshire marbles, which are very beautiful.

MARCGRAVIACEÆ, *mark'-grai-ve-ai'-se-e.*—The *Marcgravia* family, a small natural order of *Dicotyledones*, sub-class *Thalamifloræ*, generally regarded as being allied to *Clusiaceæ* and *Hypericaceæ*. There are 4 genera and 26 species, generally natives of equinoctial America. Little is known of their properties. *Marcgravia umbellata* is said to be diuretic and antisyphilitic. Curious pitcher-like bracts occur in some of the genera.

MARCHANTIA, *martsh-an'-te-a* (after M. Marchant, a French botanist).—A genus of liverworts. *M. hemispherica* and other species have been employed in the form of poultices in dropsy.

MARE, the female of the horse. (*See* EQUIDÆ and HORSE.)

MARGARIC ACID, *mar-gar'-ik* (from Gr., *margaron*, a pearl).—A fatty acid, insoluble in water, but dissolving in boiling alcohol, from which it separates in beautiful crystalline forms. In combination with glycerine, it forms the fat known as margarine. In combination with alkalie, this acid is found in most of the animal fluids, except the urine.

MARIGOLD. (*See* CALENDULA.)

MARJORAM, *mar'-jo-ram.*—A genus of plants (*Origanum*) of the natural order *Labiatæ*, annual, perennial, and shrubby plants, natives of eastern countries and the shores of the Mediterranean. All the species yield a yellow essential oil. The Common Marjoram (*O. vulgare* and the Sweet Marjoram are used in this country as a seasoning in cooking and infusions as a stimulant and tonic.

MARKING-NUT. (*See* SEMECARPUS.)

MARL, *marl* (Welsh).—Strictly speaking, clay containing carbonate of lime; but the term is now loosely applied to any clayey earth used in fertilizing land.

MARMOSET, *mar'-mo-set.*—A popular name for small American monkeys, which resemble, in some respects, the monkey of the Old World. Unlike all other monkeys, they are not quadrumanous, that is, the thumb is not opposable. The tail is very long and covered with hair. They are attractive in appearance, and very affectionate, and are in favour as pets. The fur is long and soft, of a dark-grey or reddish-yellow colour, banded with black. The head is black, with a long tuft of white hair on each side.

MARMOT, *mar'-mot* (Ital., *marmotta*).—A genus (*Arctomys*) of rodent animals, of which there are many types. They have five molar teeth on each side above, and four below, bristling with points; accordingly, some species are easily induced to feed on flesh, and will eat insects as well as vegetables. They are short-legged animals, with a tail round and rather short; they also possess a large and flattened head. They pass the winter in a state of torpor, in deep holes, the entrance of which they close up with hay. They are generally gregarious and are easily tamed. The Alpine marmot (*Arctomys Alpinus*) is about as large as a rabbit, with a short tail, and covered with a yellowish-grey fur, varied with ash-coloured tints towards the head. This species inhabits the Alps and Pyrenees, just below the region of perpetual snow. Marmots partake of many of the characteristics of the squirrels, and that they are both herbivorous and carnivorous. The American marmot (*Arctomys ludovicianus*) is known as the Prairie Dog (which *see*).

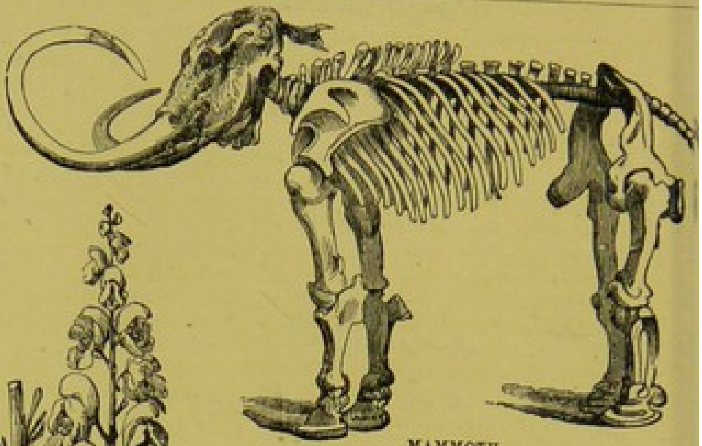
MARROW, *mar'-ro* (Lat., *medulla ossium*) —A light fatty substance lodged in the interior of the bones of mammals. Like ordinary adipose tissue, it consists of vesicles containing fat, with blood-vessels distributed to them. It is usually of a yellow colour, with 96 parts of fat, 3 of water, and 1 of areolar tissue, in 100 parts. In some parts it is of a reddish colour. In birds, for the sake of lightness, the larger bones, instead of being filled with marrow, contain air, which passes into them from the lungs.

MARRUBIUM, *mar-ru'-be-um* (Heb., *marrob*, a bitter juice).—A genus of the natural order *Labiatæ*. The species *M. vulgare* is the common horehound, which is much employed as a domestic remedy in coughs.

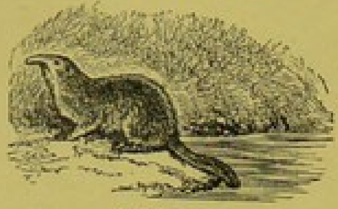
MARS, *marz.*—One of the principal planets in our system, the fourth in the order of distance from the sun, and consequently the next above our earth. The mean distance of Mars from the sun is 139,311,000 miles; it performs its sidereal revolution in 1 year, 10 months, and 21·98 days; and revolves on its axis in 24 hours, 22 minutes, 35 seconds. The diameter of Mars is about 4,400 miles; the equator is inclined about 28 degrees to the orbit, which is more eccentric than that of a planet in the solar system except Mercury. In Mars there must be two different seasons analogous to those we observe on the earth. In proof of this may be mentioned a singular phenomenon which manifests itself towards the north and south poles of Mars. At these points are two whitish spots, the brilliancy of which is more than double that of the other parts of the planet. The north spot diminishes in size during the spring and summer of that hemisphere, and increases during the two following seasons: the contrary takes places at the south pole. From these facts it may be concluded that these form round the poles of Mars extensive coverings of a whitish substance similar to the snows which fall from our atmosphere. Among the Jews, the planet Mars bore a name which signifies fiery; the Greeks also, who called the planet Hercules, applied to it the epithet *nuroeis*, incandescent. Even at the present day Mars is the object in the heavens which exhibits the most intense tinge of red. This colour, however, appears more intense to the naked eye than in a telescope. It is generally supposed that Mars possesses an atmosphere similar to our own.

MARSDENIA, *mars-de'-ne-a* (in honour of William Marsden, F.R.S., secretary of the

MANGROVE.

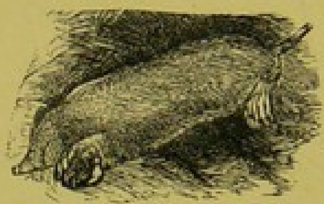


MAMMOTH.



MUSK RAT.

MONK'S-HOOD.

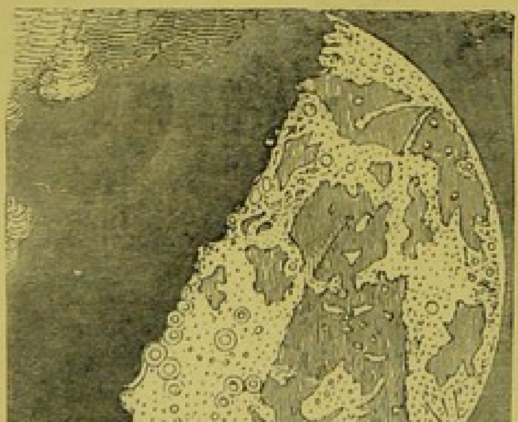


MOLE.

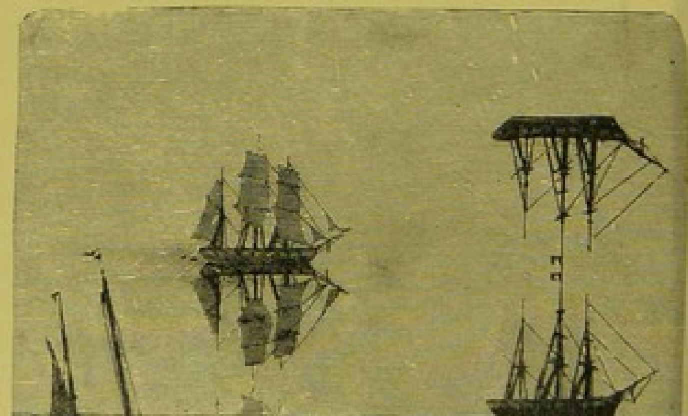
MELONS.

MOON, MAP OF.

MAIZE.



MOON, MOUNTAINS OF THE.



MIRAGE AT SEA.

Admiralty). A genus of the natural order *Asclepiadaceæ*. *M. tinctoria* produces a kind of indigo; *M. tenacissima* has very tenacious fibres, which are used for bowstrings by the mountaineers of Rajmahl.

MARSH-MALLOW.—A genus of plants (*Alshea*) of the natural order *Malvaceæ*. There are only a few species, annual and perennial plants, with showy flowers. The Common Marsh Mallow (*A. officinalis*) grows in the south of England in meadows and marshes. Herbalists use it in medicine, and in some eastern countries it is an article of food.

MARSH MARIGOLD, *mar'-i-gold*. —A genus of plants (*Catha*) of the natural order *Ranunculaceæ*. A well-known British plant is *C. palustris*, with shining leaves and large yellow flowers, abundant in damp meadows and by the sides of streams. Some persons have the flower-buds preserved in salt and vinegar, as a substitute for capers.

MARSILEACEÆ, *mar-sil-e-ai'-se-e* (after Count Marsigli, founder of the Academy of Sciences, Bologna).—The Pepperwort family, a natural order of *Acotyledones*, consisting of aquatic herbs, with small floating or creeping stems. They are widely distributed, but are most abundant in temperate regions. The most important species is the Nardoo of Australia. (*See* NARDOO.)

MARSUPIALIA OR MARSUPIATA, *mar-su-pe-ai'-le-a*, *mar-su-pe-ai'-ta* (Lat., *marsupium*, a bag).—A term applied to an extensive group of mammalia, which differ altogether from others, both by their organization and by the different varieties of nourishment which they consume. As a necessary consequence of these peculiarities, we find their structure altered accordingly, especially the organs of progression, prehension, and digestion, which are so adapted to their various wants and habits that we may trace in them some of the prominent characteristics of the carnivorous, herbivorous, and rodent forms of other mammalia. The leading feature in these mammals is the premature birth of their young, which are nourished, after their exit from the uterus, by the pouch or marsupium of the mother, in which the teats are placed, to which latter they attach themselves immediately after birth. The ursine opossum is an instance of this class, and is a native of Van Dieman's Land. The great type of the genus, however, is the KANGAROO. (*See* KANGAROO, OPOSSUM, SQUIRREL, &c.)

MARTEN, *mar'-ten* (Du., *marter*). —An elegant little animal, a genus of digitigrade carnivorous quadrupeds, belonging to the family *Mustelidæ*. There are two varieties of this species; namely, the beech marten and the pine marten; the former being possessed of a white throat, and the latter of a yellow hue. The beech marten (*Mustela Martes*) differs but little from the weasel in form, with the exception of the body being slightly more elongated, the head a little more pointed, and the fur generally longer. The martens have also an additional molar tooth in both jaws, and also the larger grinder of the lower jaw has a small internal tubercle, which does not exist in that of the weasels. The tail is about as long as the body; the upper part greyish or yellowish-brown, and the feet and tail of a chocolate hue. The fur is dense, rather soft, and long, being longer on the hind parts, especially on the tail. The under fur is thick and wooly. When young, the marten is of a darker colour, and in summer the fur is always of a lighter hue than in winter. The marten is generally distributed throughout England and Scotland, and in Europe. In the north of Scotland it is termed the taghar and polecat. In its habits it partakes of the qualities of the fox, as it is a destructive depredator at night-time of farm-yards, although it shuns men as much as possible. Its general length from nose to tail is about a foot and a half. The skins of the pine marten are imported in large quantities into Great Britain, as their fur is much used by furriers.

MARTIE. (*See* PISTACIA.)

MARTIN, *mar'-tin* (Fr., *martinet*). —This bird (*Hirundo urbica*) belongs to the *Hirundinidæ* or Swallow family, a class of birds belonging to the order *Passeres*, tribe *Fissirostres*, and subtribe *Fissirostres diurnæ*. The martin usually makes its appearance in this country a few days later than the swallow. It appears to commence its northern migration in Africa, crossing the Mediterranean along with the swallows; but its wings being on a smaller scale, it is prevented arriving as soon as the larger-winged bird. It always endeavours, like the swallow, to establish itself near the habitation of man, and as it is not a destructive bird to plants or grain, it is usually regarded with favour. The nest of this bird is generally fixed under the eaves of houses, or in the upper angles of windows; whence its name of *house-martin* and *window-martin*. The martin is one of the most regular of summer visitors to this country, and considerable numbers also go to Denmark, Sweden, and Norway; some even as far north as Lapland. It leaves about the middle of October; and if any of its last brood are unfledged, it deserts them without the slightest compunction. In the adult male the beak is short and black; the top of the head and back of a glossy bluish black; the wing and tail dull black; the chin and under surface of the body white; and the claws curved, sharp, and of a greyish horn-colour. The whole length is slightly more than five inches and a quarter; and from the carpal joint to the end of the first quill-feather of the wing the extent is about four inches and a quarter. The *sand martin*, or *bank martin*, is another variety. This bird is the smallest of the *Hirundinidæ* that visit this country, as it is also the earliest. The whole length is about four inches and three-quarters. The beak of the adult birds is dark brown, the irides hazel; the head, with back and wing-coverts, as well as tail-coverts, of a mouse-brown colour; the throat, breast, and under surface of the body, pure white; and the legs, toes, and claws, dark brown, with a few short buff-white feathers on the posterior edge of the tarsus, just above the junction of the hind toe. The American purple martin (*Progne purpurea*) is a visitor to North America, where it arrives in February at New Orleans, and Boston towards the end of April. The colour of the male is a rich, deep, purplish blue, with the wings and tail brownish black; the female is of a more dusky appearance, and has the under surface of the body varied with yellowish stains. The purple martin feeds on the larger-winged insects; as wasps, bees, &c. Some specimens of this bird have been shot in England.

MASON BEE.—Those species of bees which build nests of earth or sand. (*See* BEE.)

MASON WASP.—A species of wasp (*Odynerus murarius*) which bores into hard sand or the plaster of walls, forming cylindrical holes in which the nest is made. (*See* WASP.)

MASS, *mass* (Ger., *mas*).—The quantity of matter which a body contains, upon the supposition that differences of weight are always the consequence of different quantities of matter. The mass is directly as the volume of the body multiplied into its density. The weight is constituted by the mass multiplied into the constant force of gravity. (*See* MECHANICS.)

MASTERWORT. *mas'-ter-wurt.*—A perennial plant (*Peucedanum Ostruthium* of the natural order *Umbelliferæ* It averages nearly two feet in height, has broad leaves and large flat umbels of whitish flowers. It is a native of the north of Europe and of America; and has been cultivated in this country, where the root was formerly in favour as a pot-herb, and much valued as a medicine of a stomachic, and diuretic kind. The root chewed, causes a flow of saliva and often relieves the toothache.

MASTIFF, *mas'-tif.*—One of the noblest, as well as the most powerful, varieties, *Cani molossus*, of the canine family. The mastiff is distinguished by a large head, with a broad muzzle to match, ears of moderate size and dependent, a heavy brow, thick, drooping lips, and a well-proportioned, strong body, and a full tail. The average height at the shoulder is about 26 inches, but that size is sometimes exceeded. The English mastiff is ordinarily of a buff colour, with black muzzle and ears. The ancient English breed was brindled yellow and black. A larger dog is the Tibet mastiff. It has rough hair and a bushy tail, and is generally of a black colour. The strength of the mastiff is immense, and its vigilance and faithfulness as a house-dog and guard are unrivalled.

MASTODON, *mas'-to-don* (Gr., *mastos*, a nipple; *odous*, a tooth).—A genus of extinct fossil quadrupeds, allied to the elephant, so called from certain remarkable mammillary processes of the teeth. The remains of the mastodon are found associated with those of the mammoth in the tertiary beds of England. A species of mastodon, however, larger than that found in Europe, has been found in many parts of North America. A specimen of the animal, nearly perfect, was obtained in the state of Missouri in 1840. It was exhibited at the Egyptian Hall, Piccadilly, London, in 1842 and 1843. It was greatly distorted; but having been purchased by the trustees of the British Museum, it was made to assume its natural proportions. Its proportions are as follows:—Extreme length, 20 feet 2 inches; height, 9 feet 6¾ inches; cranium, length 3½ feet; width, 2 feet 11 inches; tusks, extreme length, 7 feet 2 inches; circumference at the base, 27 inches. The remains were found imbedded in a brown sandy deposit, full of vegetable matter, with recognizable remains of the cypress, tropical cane, swamp moss, stems of the palmetto, &c., and this was covered with beds of blue clay and gravel to a thickness of about fifteen feet. Indian flint arrow-heads were also found about and under the bones of the skeleton.

MATERIA MEDICA, *ma-te'-re-a med'-e-ka* (Lat.)—A general name for the substances and agents which are employed for the relief or cure of disease; and also applied to that branch of study which elucidates the nature and properties of such substances and agents. Medicines have been defined as "all substances which have the power of modifying the actual state of one or more of our organs, and which possess this property independent of their nutritive qualities." It is not easy to define medicines or remedies as distinct from poisons, for there are many substances that act either as remedies or poisons, according to the quantities in which they are applied to our organs. The Materia Medica may be classified in two ways; the first being according to their natural history, and the second according to their physiological and therapeutic effects. In the natural history arrangement, remedies obtained from the inorganic kingdom (mineral and chemical substances) form the first class; remedies yielded by the vegetable kingdom (herbs, fruits, roots, leaves, principles separated from plants, &c.) form the second class; and remedies yielded by the animal kingdom (insects, fats, animal secretions, &c.) form the third class. Many classifications, based upon the effects of remedies, have been proposed; but they are all more or less imperfect, as several remedies produce very different effects, and many diseases are curable by different modes of treatment. The arrangement adopted by Dr. Royle, in his excellent "Manual of Materia Medica and Therapeutics," comprehends the principal features of all the best schemes of classification. The divisions of this arrangement are shown in the following table:—

A.—MECHANICAL REMEDIES. Diluents, Demulcents, Emollients. B.—CHEMICAL REMEDIES. Escharotics, Acids, Alkalies, Antilithics, Disinfectants, Astringents, Antidotes. C.—VITAL AGENTS. 1. *Evacuants or Local Stimulants.* Alteratives, Errhines, Sialogogues, Emetics, Expectorants, Diaphoretics, Diuretics, Cathartics, Anthelmintics, Emmenagogues, Rubefacients. 2. *General Stimulants.* Tonics, Stimulants, and Aromatics. Diffusible and Special Stimulants. 3. *Depressants, or Contra-Stimulants.* Narcotics, Antispasmodics, Refrigerants, Sedatives.

For description of these, see under their various headings.

MATHEMATICS, *math-e-mat'-iks* (from Gr., *mathema*, learning).—A term applied to that science which investigates the properties of magnitudes or numbers, without being descriptive of their subject matter. Mathematics are divided into two classes; namely, *pure* and *mixed*. Pure mathematics embrace such subjects where magnitude is only considered in the abstract. From the fact of this branch being founded on the simplest notions of quantity, the conclusions which are deduced from it have the same evidence and certainty as the elementary principles from which they are obtained. Pure mathematics consequently comprehend *Arithmetic*, treating of the properties of numbers; *Geometry*, treating of extension as dependent on the three qualities of length, breadth, and thickness, without considering any physical qualities with which bodies may be endowed; *Algebra*, which compares together all quantities, whatever may be their value; combinations of these three, which have given rise to *Trigonometry;* and, lastly, the *Differential* and *Integral Calculus*, which operations consider magnitudes as of two kinds—constant and variable; the variable magnitudes being generated by motion, the operations of the calculus being to determine the values of these quantities from the velocities of the motions with which they are generated. On the other hand, *Mixed Mathematics* (or, to give it its more correct term, *applied mathematics*), consider the application of *pure mathematics* to certain established physical principles; and this branch comprehends all the mathematical sciences which appertain to physics; as *mechanics*, *hydrodynamics*, *optics*, *astronomy*, *acoustics*, *electricity*, and *magnetism*. Mathematical science may be either used as a discipline of the mind, or it may be applied as an instrument in the advancement of the arts, and in studying the wonderful panorama of the world around us. Taken in the former point of view, the object of mathematics is to strengthen, by frequent examples, the power of logical deduction; to put forth a view of the difference between reasoning on probable premises and on certain ones, by constructing a body of results which do not involve, in any case, the uncertainty arising from the introduction of that which might have been false. Mathematics also tend to form the habit of concentrating the attention closely to difficulties which can possibly be only overcome by thought, and over which victory is certain, so that the right means be used. As an instrument in advancing the arts and investigating the laws of nature, mathematics enable us to acquire vast knowledge; and without their aid most of the physical and other sciences would still be in a state of embryo. This knowledge, therefore, is gained by our applying abstract truths and tried formulas in order to obtain results before hidden; and, by advancing fictitious premises, to arrive at the real truth, which custom might endeavour to conceal. It would be impossible, in the present article, to enter at length upon the metaphysical discussion of the subject. (*See* FLUXIONS, GEOMETRY, INTEGRAL CALCULUS, &c.)

MATICO, *mat'-e-ko.*—The leaves of a certain plant (the *Artanthe elongata*), a native of Peru, employed to stop bleeding. The matico was first brought into notice as a styptic by Dr. Jeffreys, in 1839. Its action is probably simply mechanical, depending on the hairs which cover its under surface. It is probably useless as an internal styptic, as which, nevertheless, it has been recommended by some writers. (*See* ARTANTHE.)

MATRICARIA, *mat-re-kai'-re-a.*—A genus of the natural order *Compositæ*. The species *M. Chamomilla* bears flowers which have similar properties to those of the true chamomile plant. (*See* ANTHEMIS.)

MATTER, *mat'-ter.*—The physical idea of matter is, that it is the substance of which any body is composed, or anything that can exert, or be acted upon by, physical force, or anything that is tangible and can affect the senses.

MAW-SEED.—A term used by some bird-fanciers for poppy seed (*papaver somniferum*), which is often given to cage-birds when moulting.

MAXIMA AND MINIMA, *maks'-e-ma, min'-e-ma* (Lat., the *greatest* and *least*).—Terms employed not to signify the absolute greatest and least (as the words imply) values of a variable quantity, but the values it has on the instant when it ceases to increase and begins to decrease, or *vice versâ*. A variable quantity may, therefore, have several *maxima* and *minima*. The theory of the *maxima* and *minima* will be found given in most elementary works on the differential calculus.

MAYACEÆ, *may-ai'-se-e.*—The *Mayaca* family, a natural order of *Monocotyledones*, subclass *Petaloideæ*, consisting of a single genus of small moss-like plants closely allied to *Commelynaceæ*. They are found in America, from Brazil to Virginia. Their properties and uses are unknown.

MAY-APPLE. (*See* PODOPHYLLUM.)

MAY-FLY, *may'-fly.* (*See* EPHEMERA.)

MEADOW-SAFFRON. (*See* COLCHICUM.)

MEADOW-SWEET. (*See* SPIRÆA.)

MEAN, *meen* (from Lat., *medium*).—A term applied in Mathematics to a quantity which possesses an intermediate value between several others, which are formed according to any assigned law of succession. The *Arithmetical Mean* is the *average* of any series of numbers, and is found by adding the values of the quantities together and dividing by their number. The *Geometrical Mean* between any two quantities, or the *mean* proportional, is a quantity which forms the middle term of a duplicate ratio, or, in other words, is the continued proportion of those terms; so that the first quantity is to the number sought as the number sought is to the third term; therefore the geometrical mean between any two quantities equals the square root of their product. The *Harmonical Mean* is such a number that, the first and third terms being given, the first is to the third as the difference of the first and second is to the difference of the second and third. (*See* TIME.)

MEASLES, *meaz'-ls* (Lat., *Rubeola*)), is a contagious fever of an inflammatory type, attended with a characteristic eruption, and all the symptoms of a violent cold; watery discharge from the eyes and nose, dry cough, hoarseness, &c. It commences with the ordinary symptoms of fever—chilliness, loss of appetite, lassitude, and almost invariably attended with inflammation of the mucous membrane lining the air-passages. The eruption commonly appears on the fourth day; at first about the head and neck, then the trunk and arms, and finally reaching the lower extremities. It takes two or three days to complete its course, and when it reaches the feet and legs, it has usually begun to disappear from the face. At the end of six or seven days from their first appearance, the papules have again disappeared. The eruption consists of little papules somewhat resembling flea-bites of a dark-red colour. When the eruption is fully out, the cough, at first dry and troublesome, generally becomes softer and less frequent. All ages are liable to attack, though infants at the breast are not so liable as those somewhat older. It is not commonly a dangerous disease, though sometimes it has proved exceedingly fatal. Where danger occurs, it is from inflammation of the air-passages, when the disease may become complicated with croup; or in subjects predisposed to consumption, the seeds of that disease may be developed. In general, a simple diet and the maintenance of an equable temperature is almost all that is required, with, perhaps, the exhibition of a mild diaphoretic or expectorant. Sometimes the application of a mustard cataplasm to the chest is of advantage.

MEASURE, *mezh'-er* (Fr. *mesure*), that division of the time by which the air and motion of music are regulated. Although some affirm it to be of modern invention, there is no doubt that the ancients not only practised the division of time, but formed it upon very severe rules, founded upon principles unknown to the modern musicians.

MEDICAGO, *med-e-kai'-go* (said to be from *medike*, a name given by Dioscorides to a Median grass).—A genus of papilionaceous *Leguminosæ*, including many valuable fodder-plants. The name of *Lucerne* is commonly applied to species and varieties cultivated in this country.

MEDICINE, *med'-e-sin* (Lat., *medicina*), is the art and science of curing disease. From the accidents and infirmities to which human nature is liable, we may readily suppose this art to be almost as old as the human race. Even among the most rude and barbarous people we find some kind of appliances for curing wounds and injuries, and some means adopted to overcome internal disease. The various branches into which medicine is now commonly divided are: *Anatomy*, or a knowledge of the structure of the human body, including *histology*, which treats of the minute structures of parts discernible only by the microscope; *Practical Anatomy*, which applies a knowledge of structure to a right performance of the operations of surgery; and *Pathological Anatomy*, which points out the aberrations from the normal or healthy structure of the organs or tissues of the human body; *Physiology*, or a knowledge of the vital actions; *Pathology*, comprising the nature, cause, and cure of disease; *Nosology*, which treats of the various kinds of diseases, and tries to arrange them systematically; *Surgery*, treating of mechanical injuries, and the modes of relieving diseases and derangements by mechanical means; *Obstetrics*, or *Midwifery*, dealing with the modes of facilitating delivery, and the diseases of children; *Materia Medica*, or the science of medicines, their nature, composition, and effects; *Pharmacy*, or the preparation of medicines; *Therapeutics*, the application and administration of every kind of remedy; *Hygiene*, treating of the laws of health; *Dietetics*, dealing with the rules of diet; *Medical Jurisprudence*, or the application of the science of medicine to the administration of law; *Clinical Medicine*, or the instruction communicated at the bedside of the patient; *Psychological Medicine*, or the nature and treatment of mental diseases. Intimately connected with medicine are the sciences of *Natural Philosophy*, *Chemistry*, *Zoology*, *Botany*, *Mineralogy*, *Meteorology*, &c.

History of Medicine.—In the earliest ages of civilization, we find medicine in the hands of the priests, perhaps from the idea that disease is occasioned by the anger of the gods; and hence its treatment was accompanied with many superstitious rites. The Egyptians must have been possessed of a considerable knowledge of the human body and the nature of disease, from the high degree of perfection to which they had brought the art of embalming; and hence, probably, Moses, who was learned in all the knowledge of the Egyptians, may have acquired that practical knowledge of the nature of disease which appears in his writings. In the Odyssey of Homer, mention is made of a drug "that frees men from grief and from anger, and causes oblivion of all ills." The early history of medicine in Greece is involved in obscurity; but it must have made considerable progress before the time of Hippocrates (born about B.C. 460), who collected the scattered knowledge of his time and added to it by his own genius and observation. The improvements which he made in medicine appear to have been so considerable that for many centuries his successors were content to follow him in reverential imitation. The great merit of Hippocrates lies in his descriptions of disease; and, bearing in mind the limited scope of his inquiries, we cannot but admire the sagacity of his observations. Soon after its foundation, Alexandria became the centre of the science and learning of the time, and medicine, in particular, was assiduously cultivated, and a knowledge of the human body was acquired by dissection, particularly by Herophilus and Erasistratus; for up to that time the knowledge of the human body had been drawn by analogy from dissections of the lower animals. For some centuries after this time, physicians were divided into two classes—the Dogmatics, or followers of Hippocrates, who maintained that, to treat disease, we must be acquainted with its occult as well as exciting causes, and with the natural actions of the human body; while the Empirics, on the other hand, held that such knowledge was unattainable and unnecessary, and that experience ought to be the sole guide in practice. During the early period of the Roman empire, medical science appears to have been but little cultivated. The first physician of note who practised at Rome was Asclepiades of Bithynia, who was a contemporary of Cicero. His pupil, Themison of Laodicea, was the founder of the sect of the Methodists, who were intermediate between the Dogmatists and Empirics; and while the Dogmatists regarded the fluids as the seat of disease, the Methodists believed that the solids were first affected, and that the derangement of the fluids was but secondary. The most distinguished succeeding physicians of the Methodists were Soranus and C. Aurelianus. Celsus, who flourished probably towards the end of the 1st century, has, in his work *De Medicinâ*, given us a digest of all that was known on the subject up to his time. This work takes almost equal rank with the Hippocratic writings, and shows the great progress which medicine had made through the labours of the anatomists of Alexandria. He treats of most of the great operations of surgery, of wounds in the intestines, injuries of the brain, the use of ligatures, &c. Aretæus of Cappadocia, who flourished probably in the early part of the 2nd century, has left a treatise on diseases, which is one of the most valuable of ancient medical works, and is remarkable for its accuracy and spirited description. The next individual of note in medical science is Galen, a native of Pergamus, who came to Rome at the invitation of the emperor Marcus Aurelius, about A.D. 165. Having mastered all the theories and knowledge of his times, he gave his talents and labour to constructing a summary of them. His works are therefore very voluminous, and constitute a perfect encyclopædia of the medical science of the day. For many centuries after his time physicians were content with rigidly following him. His writings were regarded as the ultimate authority on all points; and everything that seemed opposed to them was at once rejected. The only writers of note were Oribasius (A.D. 360), Aëtius (525), Alexander of Tralles, Procopius (540), and Paulus Ægineta (600-640). The last of these, a learned and talented physician, was a voluminous compiler, and may be said to have brought the science of medicine in the Eastern empire down to his own time. From that time down to the 12th century, the Arabians were the only people among whom medicine made any progress. On the taking of Alexandria, they became acquainted with the writings of Hippocrates, Galen, and others, whose works were soon after translated into Arabic, and diligently studied. One of the most distinguished of the Arabian school was Rhazes, who flourished at Bagdad towards the end of the 9th century. He was a voluminous writer; but his works are chiefly compilations from the Greeks, though he also wrote some original treatises, particularly one on small-pox and measles. But the most distinguished author of this school was Avicenna (born 980), who has been styled the Galen of the Arabian empire. His great work, the "Canon," became the text-book of Arabian commentators and teachers during the 12th and 13th centuries. Avenzour and Averrhoes, who flourished in Spain in the 12th century, were also distinguished members of the Arabian school. During the rest of the middle ages there existed a sort of Galeno-Arabian science of medicine, mostly fostered by ignorant monks, and suffering, perhaps more than any other science, from every superstition and misconception of nature. Two of the principal medical authors were Albertus Magnus and Roger Bacon, the one a prelate in high favour with the papacy, the other a Franciscan monk. In the 12th century the medical school of Salerno was established, and followed by several others; and in the beginning of the 14th century, the study of practical anatomy was restored by Mondini at Bologna. With the fall of Constantinople in 1453, and the consequent dispersion of a number of learned men, who established themselves as teachers in Italy and other parts, and thus gave a new impulse to the cultivation of Greek medical science and literature, the study of Hippocrates was revived, and faith in Galen began to be shaken. In the beginning of the 16th century medical science in England derived great assistance from Linacre, who gave lectures on physic at Oxford, and founded the College of Physicians. With Paracelsus, in the 16th century, began the sect of chemical physicians, who, contemning the learning of the Galenists, devoted themselves to the study of chemistry, maintaining that the operations of the human body are subject to the same laws as govern inorganic matter. In the 17th century, a number of very distinguished names appear in medicine; as Harvey, who discovered the circulation of the blood, Asellius, Sydenham, Malpighi, Riolan, Pecquet, Bartholin, Fabricius, Sylvius, Willis, Fallopius. The beginning of the 18th century was characterized by the establishment of clinical medicine, or bedside teaching, on a systematic plan, by Boerhaave, who was appointed lecturer on the theory of medicine at Leyden in 1701, and four years later became physician to St. Augustine's Hospital, when he commenced a systematic course of clinical lectures. He was, besides, a man of extensive erudition, and brought order and system out of the vast mass of materials that had been accumulating during the preceding century. He likewise advanced practical medicine in all its departments. Among his pupils were Van Sureten and Haller, the former of whom followed his master too closely to add much of real value to the science; but the latter greatly improved it, particularly in the department of physiology. In England, William and John Hunter laid the foundation of the English school of physiology. Dr. Cullen, of Edinburgh, with his varied knowledge and great original powers, rendered eminent service in systematizing the study of practical medicine. In the present century medical knowledge has made great advances. A much more minute and accurate knowledge of the human body has been obtained; the nature of many of its vital processes has come to be understood; and the characteristics of the different diseases, and the means of counteracting or controlling them, are much better known.

Medicinal Plants.—The name often given to those plants, some part or product of which is used to cure disease or heal wounds. Those plants which are recognized by educated medical practitioners, and are placed in the pharmacopœias of civilized countries, are called *officinal*. Many plants used by uneducated persons are really useful, and would be recognised by medical men, but they have others which better answer the same purpose. Other medicinal plants, again, used by uneducated people are quite useless, and in some cases harmful. Medicinal plants are sometimes gathered in their wild state, while others are cultivated. Mitcham, near London, contains a larger number of gardens of medicinal plants than any other part of Great Britain.

MEDICLE, *me'-dicle.*—A genus of plants something like the clover, and generally sown in Britain when a close turf is required with rye-grass and red clover. There are a large number of species, some found in Britain, but more in the south of Europe. They have trifoliate leaves and a sickle-shaped or spirally twisted legume.

MEDLAR, *med'-lar.* (*See* MESPILUS.)

MEDULLARY SARCOMA, *me-dul'-la-re sar-ko-ma*, the most malignant form of cancer. (*See* CANCER.)

MEDUSA, *me-du'-sa*, OR GORGON-HEADS (*Ophiuridæ*).—A species of marine animals, belonging to the class *Echinodermata*, and commonly known by the appellation of lizard-tailed star-fishes. The *gorgon-heads* have all an obicular depressed body, with five arms, which are cylindrical, jointed, and very flexible; these arms are often extremely long, and sub-divided into branches; they are covered with scales, somewhat like the tails of serpents, and are very fragile. Their means of progression are consequently very different from those of the true star-fishes; as, when they move, they employ the two arms that are nearest the point to which they wish to proceed; and the one also farthest from that point. The two in front pull the animal along by means of hooks at their ends, while the one behind is pushed into the sand, and is employed to shove it on. The *Ophiuridæ* live nearly exclusively on sandy shores, and on the approach of any danger they hide themselves in the mud; like several others, they quickly recover the loss of their arms, as they grow again in a few days. There are numerous varieties of this family, of which the one just described is the type.

MEERSCHAUM, *meer'-shaum* (Ger., foam of the sea).—A peculiar silicated magnesian mineral found in several parts of Europe, but mostly in Greece and Turkey. In the last-mentioned country it is extensively used as fuller's-earth; but in Austria and Germany it is adapted to the manufacture of tobacco-pipes, which are prepared for sale by being first soaked in tallow, afterwards in wax, and being finally polished with shave-grass. The true meerschaum always turns from a pure milk-white to a brownish-black colour when smoked for some time, by reason of the influence on it of the tobacco-oil; and to connoisseurs this is a true criterion between true and false meerschaum, the latter of which is also extensively manufactured.

MEGALICHTHYS, *meg'-al-ick-this.*—A fossil genus of gigantic carnivorous fishes, long since extinct. Remains of these creatures have been found in the carboniverous strata of England and Scotland.

MEGALOSAURUS, *meg'-al-o-sau-rus.*—A fossil genus of gigantic lizards of carnivorous habits, long since extinct, whose remains have been discovered in the lower Oolite formation.

MEGAPODIDÆ, *meg'-a-po-di-dee.*—A family of birds inhabiting New Holland and the neighbouring islands, classed by most naturalists amongst the gallinaceous birds. The feet are large, with big, blunt claws.

MEGATHERIUM, *me-ga-the'-re-um* (Gr., *megas*, great; and *therion*, beast).—A name given by Cuvier to the typical representative of a series of endentata quadrupeds, the largest and most gigantic of terrestrial mammals. Two specimens of this animal have been found in America, the one termed the *Megatherium Cuvieri*, and the other the *M. Jeffersoni*—the latter being first described by President Jefferson, as may be seen by the "Transactions of the American Philological Society" (iv. 246). The haunches of the megatherium named after Cuvier must have exceeded five feet in width, while its body was about twelve feet long and eight feet high. Its feet were a yard in length, and terminated in formidable compressed claws of great size; its tail was also of great length and thickness, exceeding the size of that member in either living or extinct quadrupeds. The head of the megatherium was of comparatively small size, and the cranium presents many of the peculiarities of the sloth, from which circumstances it has been termed the *giant sloth*. Not much is known of this immense animal; but, according to the authority of eminent naturalists, it possessed a scaly armour; whence it must also have been closely allied to the armadillo family.

MEGRIM, *me'grim* (Fr., *migraine*).—The old-fashioned term for neuralgia seated in one-half of the head, or only the brow or one side of the forehead. It is often periodic, and may be induced by any cause that debilitates the system. Iron or quinine should be tried according to the particular symptoms.

Megrims and Vertigo are terms applied to attacks of insensibility which sometimes overtake a horse when at work. They generally occur from fulness of blood in the veins of the head, and the horse reels or stands stupidly inert, or falls to the ground. Sometimes there are tumours on the brain, which cause these attacks. A horse liable to these diseases should be moderately fed.

MELALEUCA, *mel-al-lu'-ka* (Gr., *melas*, black; *leukos*, white, because the trunk is black and the branches white).—A genus of the natural order *Myrtaceæ*. The species *M. minor*, or *Cajeput*, is a small tree of the Molucca Islands. Its leaves, when allowed to stand so as to undergo a species of fermentation, and then distilled with water, yield a volatile oil of a limpid nature and a light-green colour. This product, which is called cajeput-oil, was formerly much employed as a remedy in cholera, but without any success. It has been used internally as a diffusible stimulant, anti-spasmodic, and diaphoretic, and externally, when mixed with olive-oil, as a stimulant embrocation. It has the property of dissolving caoutchouc. In Australia the leaves of the species *M. scoparia* and *genistifolia* are used as substitutes for tea.

MELANCHOLIA, *mel-an-ko'-li-a*.—A variety of insanity, consisting of great mental gloom and intense exaggeration of the natural feelings of grief and despondency. There is usually defective blood nutrition, and the physical aspect is that of great exhaustion and inanition.

MELANORRHŒA, *mel-an-or-re'-a*.—A genus of trees of which the Black Varnish Tree of Burmah may be taken as the type. This tree, growing often to the height of 100 feet, yields a thick juice, which, becoming black on exposure to the air, is much valued as a varnish for painting boats, &c.

MELANOSPOREÆ. (*See* ALGÆ.)

MELANTHACEÆ, OR COLCHICACEÆ, *mel-an-thai'-se-e, kol-tshi-kai'-se-e* (Gr., *melas*, black; and *anthos*, a flower).—The Colchicum family, a natural order of *Monocotyledones*, sub-class *Petaloideæ*. The plants of the order are generally diffused, but most abundant in Europe, North America, and Northern Asia. There are 3 genera, which include 130 species. They are generally poisonous, owing to the presence of powerful alkaloids. In proper doses, however, several are valuable medicines. (*See* VERATRUM, COLCHICUM.)

MELASTOMACEÆ, *mel-as-to-mai'-se-e* (Gr., *melas*, black; *stoma*, the mouth; the black berries of some of the species are eaten by children, whose mouths they stain black).—The *Melastoma* family, a natural order of *Dicotyledones*, sub-class *Calyciflora*. The plants of this order are principally natives of tropical regions, but a few are also extra-tropical. They are generally characterized by astringency. Many produce edible fruits, and some are used for dyeing black and other colours. A number of species are cultivated in this country on account of the beauty of their flowers.

MELIACEÆ, *me-le-ai'-se-e* (from Gr., *meli*, honey, from its aromatic flavour).—The *Melia* family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*. The order is very nearly allied to *Cedrelaceæ*, the Mahogany family. There are 33 genera and 150 species, found more or less in all tropical regions. Some produce edible fruits, others have valuable oil-yielding seeds, and some are remarkable for their medicinal properties, which in general are bitter, tonic, and astringent, but in some cases are purgative and emetic. The most interesting member of the order is *Indica Azadirachta*, the *Neem-tree* or *Pride of India*, or, as it is sometimes called, the *Margosa-tree*. It possesses febrifugal properties. The pericarp yields, by expression, a fixed oil, which is used for burning. The tree also yields a kind of toddy, which is employed as a stomachic. (*See also* CARAPA.)

MELIANTHUS, *mel-e-an'-thus* (Lat., *mel*, honey; *anthos*, a flower).—A genus of the natural order *Zygophyllaceæ*, or, according to the views of some botanists, the type of a distinct order termed *Melianthеæ*. The flowers of the species *M. major* contain much saccharine matter, which is extracted and used as food by the natives of the Cape of Good Hope, where the plant abounds.

MELIC GRASS, *me'-lick*—A genus of grasses of which one only, *M. uniflora*, is common in Britain. It grows generally in the shaded woods, and is of graceful appearance. *M. nutans* is also found in this country, but it is much rarer.

MELILOTUS, *mel-e-lo'-tus* (from Lat., *mel*, honey, and *lotus* honey-lotus).—The Melilot, a genus of papilonaceous *Leguminosæ*. The flowers and seeds of *M. officinalis*, and other species, possess a peculiar fragrance, which is due to the presence of *coumarine*. They are used to flavour *gruyère* and other kinds of cheese.

MELISSA, *mel-is'-sa* (Gr. *melissa*, a bee).—A genus of the natural *Labiatæ*. *M. officinalis*, common balm, possesses mild stimulant properties, and its decoction is used as a diaphoretic in fevers, as an exhilarating drink in nervous affections, and as an emmengogue. The bees obtain a great deal of honey from the balm.

MELOCACTUS, *me-lo-kak'-tus* (Gr.), in Botany, the Meloncactus, a genus of the natural order *Cactaceæ*. The fleshy stems of this genus have been likened to large green melons, to turbans, and to hedgehogs. In the dry districts of South America they are eaten by cattle on account of their juice.

MELON. (*See* CUCUMIS and CUCURBITA.)

MEMBRANA PUPILLARIS, *mem-bray'-na pu-pil'-la-ris*.—The thin membrane which covers the eye in the fœtus before the seventh month of gestation. It disappears at this period.

MEMBRANE, *mem'-brane*—Thin textures or "skins" in the bodies of animals which cover organs or line the anterior of cavities; thus the *mucous membrane* is the anterior lining of the human body, commencing at the lips and terminating at the outlet of the bowels.

MEMORY, *mem'-o-re* (Lat., *memoria*; Gr., *mneme*), is one of the most important of all our faculties. It is obviously the great foundation of all mental improvement, being that which enables us to treasure up for future use the knowledge we acquire, and without which no advantage could be derived from the most enlarged experience. Memory, perhaps more than any other faculty of the mind, is dependent upon the physical condition of the body. We may smile as we read in the old writers on memory, of plasters and powders and perfumes for strengthening the memory; but even in the present day, Sir B. Brodie says that it is possible that, by accurate observation, the proper means may be discovered of preserving that temperament of the brain which is favourable to memory; all indicating a belief in the dependence of memory upon physical conditions. The term memory implies two things; namely, retention and reproduction—the capacity of retaining knowledge and the power of recalling it to our thoughts when we have occasion to use it. These vary greatly in different individuals, some having a good retention but a bad recollection; others a good recollection but a bad retention. Though apparently so different in character, yet we are inclined to regard them as the result of one principle—that of association; the man of recollection having his ideas so connected that the one readily calls up the other; the man of retention having them so intermixed and interwoven that it is only after a time or by some lucky chance that the right idea comes up. Indeed, so far as retention is concerned, it is held by many philosophers that whatever has once been the object of consciousness is ever after retained, its being recollected or not depending entirely upon the laws of association. In support of this doctrine, we have numerous instances of persons recollecting, in the delirium of a fever, things which had long since been forgotten, or even speaking in a language—that of their childhood—which had otherwise long passed from the mind. Not the least singular feature of memory is the way in which it is affected by certain diseases of the brain. Sometimes the patient loses the whole stock of his knowledge acquired previous to the disease, the faculty of acquiring and retaining new information remaining entire. Sometimes he loses his memory of words and retains that of things, or he may retain his memory of nouns and loose that of verbs, or *vice versâ*. But perhaps the most singular case—and it is not very uncommon—is when one language is taken entirely out of his retention without affecting the memory of others. Memory, then, as we have said, depends upon the association of ideas, by which one thought, feeling, or emotion tends to recall or reproduce another. In the article ASSOCIATION OF IDEAS (which *see*), we have attempted to refer the different laws of association to one—that of contiguity; ideas that have been in the mind together, or in close succession, ever after manifesting a tendency to recall or reproduce one another. Hence it follows, as a general rule, that the closer two or more ideas are brought together in the mind, the more strongly will they be associated, and the greater will be their power of reproducing one another. Where any interval takes place beween ideas which we wish to associate together, irrelevant ideas will be apt to intervene and weaken their adhesion. Hence the importance to memory of sound health and a mind free from anxieties. The objects of memory are either things external to us, or internal states and modes of consciousness. There are different kinds of memory—as, *e.g.*, figures, names, places, events, and so on; some persons being distinguished for one kind of memory, others for another. The circumstances which have a tendency to increase the retention or recollection of anything are chiefly vividness, repetition, and attention. Ideas that make a vivid impression on the mind are readily recalled, as also, on the same principle, those to which the attention has been specially directed. The longer an idea is before the mind, or the more frequently it is recalled, the better is it remembered. (*See* MNEMONICS.)

MENINGITIS, *me-ning-i'-tis.*—Inflammation of the middle and innermost of the membranes covering the brain. In children it is sometimes described as acute hydrocephalus. In adults it is caused by blood-poison, intemperance, sunstroke, &c. A competent physician should at once be consulted.

MENISPERMACEÆ, *mene-sper-mai'-se-e* (Gr., *mene*, the moon; *sperma*, seed).—The Moon-seed family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ;* consisting of trailling or climbing shrubs, with alternate, simple, and exstipulate leaves, and small unisexual flowers. The sepals, petals, stamens, and carpels have a ternary arrangment. The carpels are distinct, and supported on a gynophore. The fruits are drupaceous, curved around a central placental process, and 1-celled. Seed solitary, curved; embryo curved; albumen absent, or small in amount. The plants of this order are chiefly found in the forests of the tropical regions of Asia and America: none occur in Europe. They are remarkable for their narcotic and bitter principles. (*See* ANAMIRTA, COCCULUS INDICUS.)

MENOPOME, *me'-no-pome.*—A large batrachian somewhat resembling a huge newt, found on the large mud-banks of the American rivers, and known in that country by a variety of names —such as mud-devil, young alligator, &c. It is about two feet long, and has a number of small, sharp teeth.

MENTHA, *men'-tha* (Lat.)—Mint, a genus of the natural order *Labiatæ.* Several species are used in medicine, and as sweet herbs for flavouring, &c. Three are official; namely, *M. viridis*, spearmint; *M. piperita*, peppermint; and *M. Pulegium*, pennyroyal. They all possess stimulant and carminative properties.

MENYANTHES, *men-e-an'-thees* (Gr., *men*, a month; *anthos*, a flower; in allusion to the duration of the flowers), a genus of the natural order *Gentianaceæ.* *M. trifoliata* is known commonly by the names *buck-bean*, *bog-bean*, or *marsh trefoil.* The leaves and rhizome are tonic and astringent, and in large doses cathartic and emetic. In some parts of Germany the plant is employed as a substitute for hops in beer.

MERCURY, *mer'-ku-re* (after the god), symbol Hg (hydrargyrum), equivalent 100, spec. grav. at 40° Fah. 13·39, at 60° Fah. 13·59.—Mercury is one of the seven metals known to the ancients, and is, with the exception of bromine, the only element fluid at ordinary temperatures. It is found in nature in the form of cinnabar, or sulphide, in the clay-slate and red sandstone underlying the coal-measures. The most famous cinnabar-mines are those of Almaden in Spain, Idria in Transylvania, and New Almaden in California. It is also found in large quantities in China and Japan, and at Huancavelica, in Peru. Mercury freezes into a malleable mass at 40°, and boils at about 660° Fah. It was supposed at one time to be non-volatile at ordinary temperatures; but the experiments of Karsten prove that even at 32° the volatilization of the metal is perceptible. When pure it is not tarnished by exposure to the air, and does not decompose water at any temperature. Heated in a current of air to 700° or 800°, it becomes gradually converted into the red oxide. Hydrochloric acid does not act upon it, either hot or cold. Sulphuric acid does not effect it in the cold; but when heated, sulphurous acid gas is formed, which passes away, leaving the sub-sulphate of the metal behind. Strong nitric acid dissolves it readily, nitrate of mercury and deutoxide of nitrogen being formed.

MERCURY.—The planet nearest the sun, from which its mean distance is 35,392,000 miles, or somewhat more than a third of the earth's distance. Its mean sidereal revolution is performed in 87·96926 mean solar days. Mercury being an inferior planet, always appears in the neighbourhood of the sun, and is very seldom visible to the naked eye. During the interval which elapses between the disappearance of Mercury in the evening and its reappearance in the morning, a beautiful black spot is sometimes observed on the sun, which enters at the eastern margin of the disc, passes over the centre, and then vanishes. This spot is Mercury, passing between the sun and the earth, and producing a veritable partial eclipse of the sun, which is called a *transit*. The mean distance of Mercury from the earth is about 29,500,000 miles. The apparent diameter of Mercury oscillates between 4·4″ and 12″; its real diameter is 3,082 miles, or a little more than a third of the diameter of the earth. Mercury is the densest of the planets, its density being 1·234, that of the earth being taken as unity. The light of Mercury is bright and twinkling; and when observed through a telescope with a high magnifying power, in the evening, regular phases may be observed. When it emerges from the rays of the sun, its form almost resembles a complete circle; as it recedes from the sun, the western part preserves its circular form, while the eastern region becomes elliptical; gradually it changes its form, and grows more hollow, till it finally plunges into the rays of the sun, resembling a very slender crescent. If the planet is observed on the day when it emerges in the morning from the rays of the twilight, and on the following days, the same series of phenomena will be perceived, only occurring in a reverse order. From these facts it is affirmed that the planet derives the whole or greater part of its light from the sun, and that it revolves round that body in a curvilinear orbit.

MERCURY, DOG.—A genus of plants of the natural order *Euphorbracea* (which *see*). Only one is common in Britain—the common dog mercury; it is found in woods and shady places, and is very poisonous.

MERGANSER, *mer-gan'-ser*.—A genus of birds of the order *Anatidæ*, *Mergus*, the distinguishing feature of which is that they have a slender, straight, hooked bill notched at the edges. The Goosander is the largest and best known species in Britain, but it is only seen on our northern shores and in severe weather. It is larger than a wild duck, is web-footed, and feeds on fish and crustaceans.

MERIDIAN, *me-rid'-e-an* (from the Lat., *meridies*, the mid-day).—The great circle of the sphere which passes through the earth's surface and the zenith of the spectator. It is consequently the circle on which the latitudes of places are reckoned, commencing from the equator, which it intersects at right angles. What is termed the *terrestrial meridian* is the great circle formed by the intersection of the surface of the earth by the plane passing through the poles and the spot on which the spectator may be standing. The *first meridian* is the meridian from which longitudes are reckoned: it differs accordingly, as its position is perfectly arbitrary, most nations fixing it from the capitals of their several countries. For instance, the first meridian of French astronomers is reckoned from Paris; that of England from Greenwich, &c. (*See* LATITUDE AND LONGITUDE.) The *meridian* of a globe is a brass ring in which it is enclosed, and capable of being moved round in any direction. This meridian is graduated with meridian lines, traced generally 15° from each other; so that the difference of longitude corresponds to any hour of time.

MERINO, *mer-e'-no*.—A breed of sheep, originating in Spain, but now common to the whole of Europe, and also to Australia. The male has large spiral horns, bending backwards, and not rising above the level of the head. The fleece is long, soft, and silky, and yields the finest of wool.

MERLIN, *mer'-lin*, sometimes called the Stone Falcon, because it builds its nest on the ground, and is partial to districts where dry stones are plentiful. It is a small but powerful bird of the tribe *Falconidæ*, hardly larger than a blackbird, but very brave and bold. It has a hooked beak and strong wings, and in former days, when falconry was in vogue, was in great repute for letting fly at partridges and wood-pigeons.

MERMAID'S GLOVE (*Halichondria palmata*).—The largest of the sponges found in the deep water of British seas. It is of yellowish colour, and has a very porous surface. It received its name because the arrangement of its branches is sometimes supposed to resemble that of the finger of a hand.

MEROPIDÆ, *me-rop'-i-dee*. (*See* BEE EATER.)

MERULIDÆ, *me-ru'-li-dee* (sometimes called *Turdidæ*).—A large family of birds belonging to the order *Insessores*, sub-order *Dentirostres*, widely spread over the world, having compressed bills, pointed and arched, and also slightly notched. Their food generally consists of berries, worms, and insects. The thrush, blackbird, field-fare, ring-ouzel, &c., of this country, and the orioles and mocking-birds of America, belong to this family.

MERULIUS, *mer-u'-le-us*.—A genus of

Fungi. The species *M. lacrymas* and *vastator* are two of the fungi which occur in the *dry rot* of timber.

MESEMBRYACEÆ, OR FICOIDEÆ, *me-sem-bri-ai'-se-e* (Gr., *mesembria*, mid-day; *anthémon*, flower).—The Ice-plant or Fig-marigold family, a natural order of *Dicotyledones*, sub-class *Calyciflorœ*, having the following essential characters:—Succulent herbs or shrubs, with simple exstipulate leaves; sepals definite, generally more or less united to the ovary; petals very numerous, or absent; stamens perigynous; ovary inferior, or nearly superior; styles distinct; placentas axile, free, central, or parietal. Fruit capsular or indehiscent. Seed with a curved or spiral embryo on the outside of mealy albumen. The plants of this order are natives exclusively of warm and tropical regions. There are 16 genera and 440 species. Several are edible; others yield large quantities of soda when burnt. (*See* next article.)

Mesembryanthemum, *me-sem-bri-an'-the-mum* (Gr., *mesembria*, mid-day; *anthemon*, flower).—The typical genus of the natural order *Mesembryaceœ*. The species *M. crystallinum* is the *ice-plant*, so called from its surface being studded with little watery vesicles of an ice-like appearance. Its ashes contain a large proportion of soda. The leaves and fruits of some species are eaten by the natives of South Africa.

MESENTERY, *mes'-en-ter-re.*—The broad double fold of the great serous membrane of the abdomen, called the peritoneum, which retains the small intestines in their place in the abdominal cavity. The bowels are arranged around its longer margin, so that perfect freedom of movement of each is attained, while yet each portion is made to keep its proper place. Between its folds, it contains the mesenteric vessels and the mesenteric glands. The former take blood to and from the intestines, while the latter, which are nearly 150 in number, aid in assimilating the food.

Disease of the Mesenteric Glands, or Mesenteric Disease.—These important glands are liable to disease, in which case the nourishment taken into the stomach is not passed on by them to the blood, consequently emaciation and death ensue. This disease is very common in scrofulous children; they have large stomachs and doughy flesh; sometimes the glands become so swollen that they may be felt. Beef-tea, milk, and mutton broth should be the principal diet, with an egg occasionally. Preparation of iron and lime are valuable, and bathing in sea-water is often of great benefit. This disease is sometimes called *tabes mesenterica.*

MESMERISM, *mes-mer'-izm*—A term generally applied to the phenomena of animal magnetism, and so called after the name of Mesmer, its first propounder, who lived in the latter part of the 18th century. Up to the present day, the phenomena of mesmerism have not been satisfactorily accounted for; but originally it was supposed that an analogy really existed between the action of the mineral magnet and human energy. Animal magnetism—an incorrect but convenient phrase—may be described as a power which a stronger is supposed to be able to exert over a weaker person, or a healthy over a diseased, whereby, through a mere exertion of the will in some cases, but more generally by this means accompanied by stroking with the hands, the former throws the latter into a state of sleep. During this state, certain peculiar sensations are experienced, which arise from nervous excitement, and may have good effects upon the health of the patient. The method by which mesmerism is generally performed is as follows:—The patient is placed in a sitting posture, in a convenient elbow-chair or couch. The mesmeriser, seated on a chair a little more elevated, and at the distance of about a foot from the patient, collects himself for some moments, during which he takes the thumbs of the patient between his two fingers, so that the interior parts of the thumbs are in contact with one another. He fixes his eyes upon the eyes of the patient, and remains in this position till he feels that an equal degree of heat is established between the thumbs of both parties. Withdrawing his hands, he then places them on the shoulder, where he allows them to remain for about a minute, and then conducts them slowly, with a very slight friction, along the arms to the extremity of the fingers. This operation is called a *pass*, and is repeated five or six times. *Passes* are then made over the rest of the body, ending finally with several transverse *passes* before the face and breast, at the distance of from three to four inches, the hands being approximated to each other and then separated abruptly. There are many variations of the mesmeric process, but the result, when there is no obstacle or deranging cause, is that the patient falls involuntarily into a kind of trance, the progressive sensations of which have been thus classified by Kluge, a German philosopher.—The *first* degree, called *waking*, presents no remarkable phenomena. The intellect and the senses still retain their usual powers and susceptibilities. In the *second* degree, called *half-sleep*, or the *imperfect crisis*, most of the senses still remain in a state of activity, that of vision only being impaired, the eye withdrawing itself gradually from the power of the will. In the *third* degree, called the *magnetic* or *mesmeric sleep*, the senses refuse to perform their respective functions, and the patient is unconscious. In the *fourth* degree, called *simple somnambulism*, or the *perfect crisis*, the patient is said to "wake, as it were, within himself, and his consciousness returns." He is in a state which cannot be called sleeping or waking, but which appears to be something between the two. In the *fifth* degree, called *lucidity*, or *lucid vision*, the patient is placed in what is called the state of *self-intuition*. In France, and in this country generally, this state is called *clairvoyance*: in Germany, *hellsehen*. When in this state he is said to have a clear knowledge of his own internal, mental, and bodily state, is enabled to calculate with accuracy the phenomena of disease which will naturally and inevitably occur, and to determine what are their most appropriate and effective remedies. In the *sixth* degree, called *universal lucidity*, the *lucid vision*, possessed in the former degree, extends to all objects, near and at a distance, in space and time. Many persons, however, who practise mesmerism are sceptical with regard to the existence of the two last degrees, although such cases are recorded by the best authorities on the subject. The dispassionate investigation of mesmerism has been shunned by men of science, on account of the imposture of some, and the credulity of others, of its professors. M. Reichenbach, a distinguished German chemist, gave a more scientific aspect to the phenomena of animal magnetism, by stating that he had discovered a new force in nature, called the Odic force, or Odyle. He regarded this as a peculiar force in nature, the presence of which could only be detected by persons of a highly susceptible nature.

As, however, his conclusions were arrived at principally through the medium of others, and those in a morbid state, his theory has been generally rejected. Electro-biology is only another form which the public exhibition of animal magnetism has assumed. Sleep is produced by making persons gaze for a certain length of time on a piece of money which is placed in the hand. In susceptible individuals, this produces a kind of cataleptic sleep, in which they exhibit all the phenomena of the mesmeric state.

MESOZOIC, *mes-o-zo'-ick* (Gr., middle life).—The geological periods between the most ancient and the newer life epochs. It was first used by Professor Phillips, and is synonymous with the secondary period or periods; consequently it includes the rocks of the triassic, oolitic, and cretaceous formation.

MESPILUS, *mes'-pi-lus* (Gr., *mespilon*).—A genus of the natural order *Rosaceæ*. *M. germanica* is one of our orchard trees, yielding the peculiar fruit called the medlar.

MESUA, *me-zu'-a*.—A genus of the natural order *Guttiferæ*. The species constituting it are remarkable for their very hard timber. The flower-beds of *M. ferrea* occur in the bazaars of India under the name of *Nag-rassar*. They are highly esteemed for their fragrance, which somewhat resembles that of violets. In Bengal, these flower-buds, as well as the leaves of the same plant, are employed as antidotes to snake-poisons. It is named in honour of two celebrated Arabian physicians and botanists, father and son, who resided at Damascus, and flourished in the 8th and 9th centuries.

METALS, *met'-alz* (Lat., *metallum*, a metal).—A class of opaque substances capable of conducting heat and electricity, of a shining surface (or, as it is called, of a metallic lustre), insoluble in water but fusible by heat. They may be divided into classes according to two systems, the one having for its foundation the physical, the other the chemical properties of those bodies. Percy (*Metallurgy*, vol. 1) classifies them according to their fusibility, including, however, only the economic metals in his classification. *a. Fusible below redness*,—tin, lead, &c. *b. Fusible above redness, but at temperatures easily attainable in furnaces*,—copper, gold, &c. *c. Fusible only at the highest heat attainable in furnaces*,—nickle, manganese, &c. *d. Practically infusible in ordinary furnaces*,—platinum, iridium, &c. He also divides them into—*a. Fixed metals*,—gold, copper, nickle, &c. *b. Volatile metals: after fusion*, cadmium, zinc, &c.; *without fusion, passing directly from the solid to the gaseous state*,—arsenic. The specific gravity of metals at ordinary temperatures has an exceedingly wide range, from lithium ·596, which is lighter than any known fluid, to osmium, which is as high as 21·5. All metals bear a definite form of crystallization, which is produced principally in three ways,—by slow solidification after fusion, by condensation from vapour, and by electrotypic decomposition. Metals differ considerably in their structure, not only with regard to each other but in relation to themselves. Some are crystalline, as zinc, antimony, bismuth; others are granular, like pig-iron; others fibrous, like bar iron and copper; while some few are columnar, like grain-tin; and conchoidal, as in some brittle alloys,—speculum metals, for instance. Two of the principal physical characteristics of metals are ductility, the property of being permanently extended by traction, as in wire-drawing; and malleability, which is the property of extending in all directions under the hammer. Chemically speaking, they may be divided into seven principal groups:—I. The metals of the alkalies—potassium, sodium, lithium, rubidium, cæsium. They all have an intense affinity for oxygen, and decompose water at ordinary temperatures. They form two or more oxides, both soluble in water. Thallium is supposed by Lamy to belong to this group; but the experiments of Crookes, its discoverer, prove conclusively that it is a heavy metal belonging to the lead group.—II. The metals of the alkaline earths—barium, strontium, calcium, magnesium. These metals, with the exception of magnesium, which seems closely allied to zinc in many of its properties, decompose water at all temperatures, and form one oxide pretty soluble in water.—III. Metals of the earths—aluminium, glucinum, cerium, and seven others of great rarity. These oxides are insoluble in water, and they do not decompose water at ordinary temperatures.—IV. Metals analogous to tin,—zinc, cadmium, cobalt, nickel, uranium, iron, chromium, manganese. These metals, heated to dull redness, decompose the vapour of water when transmitted over them, becoming converted into oxides, while hydrogen escapes. Three of them, iron, chromium, and manganese, form powerful acids.—V. Metals forming powerful acids with oxygen—tin, titanium, molybdenum, tungsten, vanadium, arsenic, antimony, tellurium, and one or two more.—VI. The next group contains bismuth, copper, lead, and thallium, metals which exert no decomposing action on water even at a full red heat. They form strong basic oxides, and exhibit a strong tendency to form subsalts. The last group contains the noble metals, mercury, silver, gold, platinum, and the heavy metals associated with it. These metals do not decompose water at any temperature, and have so feeble an affinity for oxygen, that their oxides, with the exception of osmium (which is allied to arsenic in some of its properties), are reduced far below a red heat. Tellurium, arsenic, and antimony form connecting links between the metallic and nonmetallic elements, being allied to the phosphorous and sulphur group in many of their chemical properties. As our knowledge of these valuable and interesting bodies extends, uses are found for many raw metals, their rarity decreasing with the demand. Sodium, lithium, aluminium, magnesium, tungsten, cerium, uranium, are instances of this; and no doubt as the sciences of metallurgy and chemistry progress, many other metals, at present only seen in the laboratory, will become common in the workshop.

METAMERIDES, *me-tam'-e-ridez* (Gr., *meta*, together; *meros*, a part).—Compounds containing the same centesimal composition, but differing so completely in their physical and chemical characters as to be considered distinct; thus, acetate of methyl and formic ether, fruit, sugar, and hydrated lactic and acetic acid, have respectively the same composition in 100 parts, but are essentially different in their properties, the ultimate atoms being grouped together in two different ways.

METAMORPHIC ROCKS, *met'-a-mor'-fiche*, (Gr. *meta*, change; *morphe*, form).—A name given by Lyell to a class of rocks such as marble, clay-slate, mica-schiste, gneiss, &c., which have become transformed from their original state to one of a more or less crystalline form. All of them contain from 60 to 70 per cent. of silica, also alumina, lime, &c., in less proportion. The causes which have brought about these transformations are very obscure, but there is little doubt but that both heat and pressure have contributed to the change. (*See* GEOLOGY.)

METAMORPHOSIS, *me-ta-mor'-fo-sis.*—In natural history, this term is applied to any change in the organization of matter: as, for instance, the transformation of food or rain into animal or vegetable organic substances; but the term is more strictly applied to those sudden changes in the form of things which are so obvious and interesting to even the unscientific observer; as the change of a pupa into a butterfly, to quote an instance from the insect world. (*See* INSECT-TRANSFORMATIONS.)

METASTASIS, *me-tas'-tas-sis* (Gr., *methistemi*, I transfer), is the sudden transference of a diseased action from one part of the body to another; as when a cutaneous eruption is suddenly checked by exposure to cold, and the disease attacks a deep-seated part; or, in gout, where the disease suddenly shifts from the foot to the stomach, or some other internal part.

METEMPTOSIS, *me-temp-to'-sis* (Gr., *meta*, after, and *pipto*, I fall).—A term used to express the solar equation necessary to prevent the new moon from happening a day too late; as *proëmptosis* signifies the lunar equation necessary to prevent the new moon happening too soon.

METEORIC STONES. (*See* AEROLITE.)

METEOROLOGY, *me-te-or-ol'-o-je* (Gr., *meteoros*, raised in the air; *logos*, a discourse).—The science which treats of the phenomena which occur in the atmosphere, and leads us to inquire into their properties and relations. In all conditions and stations in life, men are lead, by motives of necessity or comfort, to study the appearance of the atmosphere and sky, in order to arrive at some indications of the weather. Every varying appearance which may betoken some change is carefully stored up in the minds of sailors, fishermen, husbandmen, shepherds, and hunters. These results form a vague body of rules, in which facts are often stated correctly, but, through credulity, ignorance, and superstition, they are so frequently mixed up with erroneous deduction, that they form an unsafe basis for the science. To Admiral Fitzroy, in England, belongs the credit of commencing, with ability and success, the system of scientific observation which enables meteorologists to forecast the weather. Since his day observatories have been multiplied, particularly in the United States, which, telegraphing the meteorological conditions which prevail in their district to a head-office, enable that office to issue weather forecasts a few days ahead, which, in many cases, have been remarkably accurate. In order to arrive at these results, several delicate instruments have been invented. (*See* BAROMETER, THERMOMETER, HYGROMETER; and for a further explanation of the subject, see the articles dealing with the various branches of it—AIR, ATMOSPHERE, CLOUD, CLIMATE, EVAPORATION, FREEZING, RAIN, STORM, SNOW, &c.

The History of Meteorology is difficult to trace, since little information is cast upon it by the records of antiquity. The observations of the ancients were chiefly directed to changes in the weather; and by personal assiduity they were enabled to prognosticate often with considerable certainty. The philosophers of old were willing to explain the phenomena by the most vague hypotheses, referring them to stellar and planetary influences. There were also to be found, in those times, persons who were believed to possess supernatural influence over atmospheric changes. The priests of Samothrace promised auspicious winds to such as consulted their sacred oracle; and Empedocles, of Sicily, boasted in his song of a knowledge of the mystic art. At the fountain Haguo, in Arcadia, in the time of drought, the priests of Jupiter were accustomed to offer up sacrifices—touching the water with an oaken wand—when presently a vapour arose, and shortly afterwards a pleasant rain descended. Such miraculous powers were believed to be given to mortals even in more recent times; in the reign of Constantine, Sopater of Apamea was put to death because he was supposed to have stilled the winds and thereby caused the plague which then raged at Constantinople. As the study of natural science progressed, the casual precursors of phenomena were separated from the real causes, false conclusions were refuted, and the empty terrors to which they gave rise were dissipated. By wide-extended observations in all the realms of natural science, at length were gained the general rules by which the phenomena of the atmosphere are regulated. From chemistry, meteorology, borrows her analysis to determine the composition of the air itself, of the substances which it contains and by which it is acted upon; the manner in which the different processes of evaporation, freezing, thawing, &c., go on, and how they affect the state of the atmosphere; the action of those invisible and imponderable agents, light, heat, electricity, &c., and their tremendous results. From physics, meteorology takes the mechanical action of these and similar powers and substances, the weight and velocity of the air, the laws of the reflection, refraction, and motion of light, &c. By these aids, the science of meteorology explains the formation, fall, or disposition of hail, snow, rain, dew, and frost; the action of thunder and lightning; the prevalence of certain winds and their particular properties; the effect of the position of a country, and the nature of its surface on its climate and productions; and the nature and cause of meteors.

METEORS, *me'-te-orz* (Gr., *meteora*).—In a general sense, this term is applied to any of the various physical phenomena which have their origin in the atmosphere. (*See* METEOROLOGY.) In a more restricted sense, however, the word denotes those luminous bodies which appear suddenly and at uncertain times in the sky. Amongst these may be mentioned the *bolis*, or fire-ball, a luminous meteor of great splendour, moving with considerable velocity at various altitudes, and frequently of great magnitude. The meteor is generally accompanied by a tail, and disappears in scintillations, attended sometimes by an explosion, occasionally leaving a luminous track behind, after it has become invisible. Fire-balls occasionally accompany meteoric stones in their descent; nevertheless, these phenomena must be considered independent, for the balls may appear without the meteorolite, and *vice versâ*. Many extraordinary meteors have been seen and recorded; one of the most remarkable occurred on the 18th August, 1783, about 9 P.M., and was visible over a wide extent of Europe, from the north of Ireland to Rome, frequently changing its form and colour. It crossed the zenith at Edinburgh, and then appeared round and of a greenish colour, casting a shade upon the ground of a similar tint; a tail of considerable length attended it. At Greenwich it appeared like two bright balls, followed by a number of others, connected together by a luminous body, and finally terminating in a blaze, tapering to a point; the colours of the balls were different.

The height of this meteor was estimated to be far above the surface of our atmosphere, its speed was not less than 1,000 yards per minute, and its diameter was computed at 2,800 yards. Cavallo describes this meteor as seen at Windsor, when its explosion was heard like a peal of thunder, ten minutes after its rupture was observed. On the 18th November, 1803, about 8.5 A.M., a brilliant meteor appeared in London, rendering legible the writings on the signboards. Many other meteors, of more or less brilliancy, have been observed at various times. The magnificent shower of meteors of 14th November, 1866, will long be remembered; and a fine display also occurred on 13th November, 1868, visible in the United States, and another, 27th November, 1872. (*See* AURORA BOREALIS.)

METHYL, *meth'-ile* (Gr. *methu*, wine; *ule*, wood), C_2H_3, C_2H_3. The first of the hydrocarbonic radicles of the alcohols. It is a gaseous body, slightly heavier than air, and burning with a bluish flame. It is not liquefied by a cold of 0° Fah. It is obtained by acting on iodide of methyl with zinc. Its most important compound is methylic alcohol, or wood spirit. It also enters into composition of the essential of *Gaultheria procumbens*, which is a salicylate of the oxide of methyl, and may be prepared artificially by distilling wood spirit with sulphuric and salicylic acids.

METONIC CYCLE, *me-ton'-ik.*—The cycle of the moon, a period of 19 solar years, after which the new and full moon fall on the same days of the year as they did 19 years before. This cycle was the invention of Meton, a celebrated Athenian philosopher, who flourished about 432 B.C. The Metonic cycle contained 6,940 days, which exceeds the true length of 19 solar years by nine and a-half hours nearly. On the other hand, it exceeds the length of 235 lunations, or synodic revolutions of the moon, by seven hours and a-half only. The framers of the ecclesiastical calendar altered the distribution of the lunar months when they adopted this cycle, in order to accommodate them to the Julian intercalation. By this alteration, every three periods of 6,940 days were followed by one of 6,939. Consequently, the mean length of the cycle was 6,939¾ days, which coincides exactly with 19 Julian years. In the ecclesiastical calendar, the number of the year in the cycle is called the *golden number*. The cycle is supposed to commence with the year in which the new moon falls on the 1st of January.

METROSIDEROS, *me'-tro-si-de'-ros* (Gr., *meton*, the heart of a tree; *sideros*, iron).—A genus of the natural order *Myrtaceæ*. The clubs and weapons of the South-Sea Islanders are made of the hard wood afforded by various species. The *Lignum vitæ*, or *Aki* of New Zealand, belongs to this genus.

MEZEREON. (*See* DAPHNE.)

MIASMA. (*See* MALARIA.)

MICA, *mi'-ka* (from Lat., *mico*, I shine).—A mineral having a somewhat metallic lustre, and capable of being split into thin plates. It enters into the composition of most of the primary rocks. It also occurs in shales, sandstones, and other sedimentary deposits, being derived from the broken-down graniticrocks. It consists chemically of the silicates of potash and alumina, more or less coloured by peroxide of iron. The alumina is often partly replaced by lithia, magnesia, and lime. Mica has lately received important applications in the manufacture of transparent letters for shop-windows and of smoke-shades to gas-jets.

Mica-schist.—One of the metamorphic rocks (which *see*), sometimes composed of alternate layers of mica and quartz, and sometimes of mica alone, gradually passing, deeper down, into clay-slate.

MICE, OR MOUSE FAMILY, *mise* (Ang.-Sax.)—A family of rodent mammalia belonging to the order *Glires*. The domestic mouse (*Mus musculus* of Linnæus) has its ears about half the length of the head, the tail a little shorter than the head and body, and the general colour of the upper portions of the body is greyish brown, while that of the lower parts is yellowish grey. The mouse is, in fact, but a small edition of the rat, although its head may be said to be proportionally less elongated than the former species. The body of the mouse is moderately full, the head tapering, the muzzle pointed, the eyes prominent, and the ears broad and rounded, the legs being short, and the feet rather delicate than otherwise. It seems to be entirely dependent on man, as it is never found far from his dwelling. Although naturally timid, mice occasionally exhibit great boldness, and they venture quite close to any one who does not molest them. On account of their fecundity, coupled with their thievish propensities, they are extremely destructive in houses, devouring everything they can get at—meal, flour, bread, cheese, butter, tallow; in fact, nothing edible seems to escape them. Their great enemy is the cat; but even she is unable quite to extirpate them, and thus they do considerable mischief. Their ravages, however, are not confined to houses merely, as they do much damage in farmyards by entering corn-stacks, where they gnaw away to their heart's content. Their enemies, besides man, and the cat and ferret, are weasels, owls of various species, and the kestrel, all of which make the mouse their prey. It has many litters during the year, and from five to seven young ones in each litter; consequently it soon increases considerably if undisturbed. The domestic mouse is common throughout the whole of Europe, and, indeed, has extended to America and Australia.

The Wood Mouse (*Mus sylvaticus*) is likewise found throughout Europe, where it proves a great enemy to the agriculturist. It is generally found in fields and gardens, and it has a habit of piling up large stores of grain, acorns, nuts, and such like, as a provision for the winter season. It often takes possession of the deserted holes of moles, where it lays up its magazine. Its ears are about half the length of the head, the tail nearly as long as the head and body; the upper parts reddish-brown, and the lower greyish white, with a little orange-red spot on the breast.

The Harvest Mouse (*Mus messorius*) is one of the prettiest varieties of this little animal, and, in fact, it is one of the most elegant of our native quadrupeds. It builds its nest in standing corn, and during the harvest season it is carried into the barns along with the sheaves, in which places it breeds and multiplies in considerable numbers. Its whole length does not exceed two inches. Its colour is a light reddish-brown.

MICHAELMAS DAISY. (*See* ASTER.)

MICROLESTES, *mi-kro-les'-tez* (Gr., little robber).—A genus of extinct insectivorous mammals resembling no living animal, but the fossil remains of which afford the earliest evidence of the existence of warm-blooded quadrupeds.

MICROSCOPIC RESEARCH, *mi-kro-sko'-pik* (Gr., *mikros*, little; *skopeo*, I see).—The investigation of the minute structure of animals and plants by means of the microscope may be truly said to be the creation of this century, notwithstanding the previous discoveries of Leeuwenhoek, Malpighi, Hooke, and others. During the greater part of the 18th century, except as a mere toy, the microscope fell into disuse; nor was it till within the last thirty years that it was really rendered capable of yielding such a magnifying power, together with such clearness of definition, as is necessary for the investigation of the science of histology. One of the principal results of microscopic research is, that a closer unity of organization has been found to exist among the minute structures of organized beings than among the larger organs. In organized beings, Nature works out her most secret processes by structures far too minute for observation with the unassisted eye. Hence we find that the best modern books on human and comparative physiology are filled with descriptions and illustrations of minute structures. The processes of secretion, of nutrition, of generation, and even the mysterious action of the brain and nervous system, unintelligible, save in their results, by the means formerly employed, are now being gradually evolved by the labours of microscopic physiologists. Among those who have employed the microscope not only with the greatest assiduity but with the utmost benefits to science and to their fellow-creatures, have been the members of the medical profession. An extended microscopic examination has also shown that animals and plants gradually approach each other as we descend in the scale, until they meet in a common centre—the simple or individual cell. At this point, all means of distinguishing between vegetable and animal organism end, and no feature exists which, in the present state of science, can enable any one to determine to which of the two kingdoms the individual cell belongs.

MIDGE, *mij* (Sax., *mygge*), a dipterous insect, belonging to the genus *Chironomus*, of the family *Tissulidæ*. It frequents marshy situations, and has a good many points of resemblance to the gnat. The proboscis is short, thick, and ends in two large fleshy lips; the antennæ are longer than the head, and are simple, being rarely pectinate; the palpi are longer than the proboscis, the eyes acute, and the ocelli wanting. The body and legs are long and slender, the wings narrow and elongate, and the halteres, or balancers, are naked, and proportionately longer than those of the diptera. In their flight, midges can be seen continually moving about in the air during the autumn, and they ascend and descend in a vertical line with a humming, buzzing noise.

MIDRIB, the central vein of a leaf (*see* LEAF).

MIGNONETTE. (*See* RESEDA.)

MIGRATION OF BIRDS. (*See* BIRDS.)

MILDEW, *mil'-dew* (Sax., *mildeaw*).—The term applied to the thin whitish coating sometimes found on the leaves of vegetables, on paper, cloth, &c. It consists of innumerable minute fungi. The mildew of wheat is produced by the fungus called *Puccinia graminis*.

MILK, *milk* (Sax., *melce*).—An opaque, whitish secretion peculiar to the females of the class *Mammalia*, or those animals which feed their young from their teats. Milk differs as procured from various animals, but its general characteristics are the same in all. It may be looked upon as a serous fluid, holding in suspension minute white globules, composed of casein and fatty matter. When examined microscopically, these globules are found to have a diameter of ·00039 inch, and to disappear on the addition of a solution of potash. When milk is allowed to stand for some time, it undergoes spontaneous changes; a thick yellowish substance, called *cream*, collects on the surface, and the milk beneath becomes thinner and of a pale bluish colour. Butter, buttermilk, and cream-cheese, are made from cream by processes which will be found described under the articles on BUTTER and CREAM. Milk from which butter has been taken also undergoes spontaneous changes; it becomes much sourer, and congeals into a mass of the consistency of jelly. The fermentation of this coagulated mass is hastened by heat; and when certain substances are added it very rapidly takes place. Thus, acids and spirits of wine *curdle* it, as it is called; but the most powerful coagulator in use is a decoction from the stomach of animals, especially that of a calf, called *rennet*. After being thus treated, if the whole is put into a bag and squeezed, a thin fluid is forced out, and a tough whitish matter is left behind: the latter substance is called *curd*, and the former *whey*. (*See* CHEESE.) According to Berzelius, the specific gravity of milk is 1·033; that of cream, 1·204. The statements respecting the composition of human milk are much at variance, owing, probably, to the difficulty of obtaining it in sufficient quantity for analysis, and also from its mutability in regard to the relative proportions of the component parts. Its specific gravity, however, appears to vary between 1·020 and 1·025; and its solid contents, according to Meggenhofer, vary between 11 and 12·5 per cent. The milk of cows and other animals is very much used as food, and is very important as an article of diet, even among adults. It is also valuable as a food for invalids, especially those who have a consumptive tendency. In some cases of poisoning by metallic salts, such as corrosive sublimate, sulphate of copper, &c., milk is used as an antidote.

Milk Fever.—A disease of which there are two varieties, which attack the lower animals after parturition. One variety, which is almost peculiar to well-fed cows, consists of congestion and inflammation of the brain and nerve centres. Large doses of physic should be given, and the animal frequently milked. Another variety consists of inflammation of the membranes of the womb and bowels, and is treated by hot fermentations, oil and laudanum, &c.

Milk-Vetch. (*See* ASTRALAGUS.)

MILKY WAY, *mil'-ke.*—An appellation bestowed upon a whitish zone of light, which everybody must have observed in the sky. This zone makes a complete tour of the heavens, passing through the following constellations:—Cassiopeia, Perseus, Gemini, Orion, Monoceros, Argo, the Southern Cross, the Centaur, Ophiuchus, Serpens, Aquila, Sagitta, Cygnus, and Cepheus. The milky way thus traces almost a great circle of the celestial sphere; whence results a secondary arc, which, after separating from the principal arc throughout an extent of about 120° from *α* Centauri to Cygnus, becomes again confounded with it. Concerning the milky way, Sir William Herschel says:—"This remarkable belt has maintained, from the earliest ages, the same relative situation among the stars; and when examined through a powerful telescope is found (wonderful to relate!) *to consist entirely of stars scattered by billions*, like glittering dust on the black ground of the general heavens." So crowded are the stars in some parts of the milky way, that the same astronomer, by counting the stars in a single field of his telescope, was led to conclude that 50,000 had passed under his view in a zone two degrees in breadth during one hour's observation. The milky way was called by the Greeks *galaxias*; from which we derive our word galaxy. The Chinese and the Arabians call it the Celestial River. It is the path of the spirits among the savages of North America, and the path of St. James of Compostella according to the peasants of Italy. According to the ancient Greeks, the galaxy arose from the milk which the infant Hercules let fall from the breast of Juno when she pushed him away on learning that he was the son of Maia: others considered that it was not milk, but ears of corn which Isis dropped on her flight from Typhon. Some of the Pythagoreans believed it to be an old and disused path of the sun: Anaxagoras thought it was the reflection of the earth; and Aristotle considered it sublunary, and consisting of exhalations of the same matter as comets. Although Democritus hit upon the truth, it was not till the discovery of the telescope that Galileo was enabled to announce that he had resolved the whole of the milky way into stars. It is calculated that the light from the nearest stars in the milky way takes about three years to reach the earth; the light of the most distant will not arrive at the earth in less than 1,500 years.

MILLE WORT. (*See* POLYGALA.)

MILLEPEDE, *mil-le'-pede.*—The common name for many kinds of little creatures, having numerous feet, and belonging to the order *Chilognatha*, and the families *Myriapoda*, *Julidæ*, and *Polydesmidæ*. They are principally found in hot climates, but several small species are to be met with in Britain.

MILLER'S THUMB. (*See* BULL HEAD.)

MILLET, *mil'-let* (Fr.)—The common name for a great number of cereal plants, the grains of which are used as food and for making a kind of beer, in various countries. *Holcus Sorghum* is the Turkish millet; *Panicum Miliaceum*, the Indian; *Paspalum exile*, the Sierra Leone; *Setaria Germanica* and *Italica*, the German and Italian millet respectively.

MILL-STONE GRIT.—A group of strata, consisting of coarse-grained quartzose sandstone, which occurs between the mountain limestone and the superincumbent coal formations.

MIMOSEÆ, *mi-mo'-ze-e.*—A sub-order of the *Leguminosæ*, or Bean family, characterized by the petals being equal and valvate in æstivation. The plants included in this sub-order are mostly natives of tropical regions, and are remarkable for yielding gum and astringent principles. (*See* ACACIA.)

MIMULUS, *my'-mew-lus.*—A genus of plants (of which the Musk is a member), most of which are herbaceous and natives of America. They are sometimes called *monkey-flowers*.

MINA BIRD.—An Indian bird something like the Grakle (which *see*). It has the power of imitating human speech in even a greater degree than the parrot. A large variety is found in Sumatra.

MINERALOGY, *min-e-ral'-o-je* (Fr., *minéral*, and Gr., *logos*, discourse).—The science which describes the kinds of mineral material forming the surface of our planet, shows the various methods of distinguishing them, makes known their uses, and explains their mode of occurrence in the earth. The best method of acquiring this important science is by attentively studying the different specimens of minerals existing in our museums, more especially those at the British Museum and Museum of Economic Geology. They should be examined in company with some experienced mineralogist, or else with the assistance of the manuals of Dana, Nicol, or Philips. When the student has made himself pretty well acquainted with the external characters of the leading minerals, the work of collection should commence—hammer and book in hand. If, however, mineral districts cannot be visited, the student should procure from some friend, or professional mineralogist, a number of unnamed minerals. These should be made out and named by means of their hardness, fracture, colour, lustre, blowpipe reactions, and, if necessary, by chemical analysis.

MINERAL WATERS, *min'-e-ral.*—The term applied to all spring waters which possess qualities different from ordinary water. From the powerfully solvent properties of rain-water, that fluid no sooner reaches the ground and percolates through the soil, than it dissolves some of the substances with which it meets in its passage. Under ordinary circumstances, however, it takes up so small a quantity of soluble substances, that their presence does not materially affect its sensible properties: in this state it is known by the names of *river*, *spring*, and *well* water. On some occasions, however, it becomes so strongly impregnated with saline and other substances, that it acquires a peculiar flavour, and is thus rendered unfit for ordinary domestic duties: it is then known by the name of *mineral water*. The term is sometimes also applied to those springs which have no claim to repute except for their extreme purity; such as those of Malvern and Holywell. The different kinds of mineral water may be arranged in six divisions; namely, Acidulous, Alkaline, Chalybeate, Sulphureous, Saline, and Silicious springs. (*See* also AERATED WATERS.)

Acidulous Springs, of which those of Seltzer, Spa, Pyrmont, and Carlsbad are the best known, generally owe their acidity to the presence of free carbonic acid. When poured from one vessel into another, they sparkle, in consequence of the escape of carbonic acid gas.

Alkaline Waters, or those which contain a free or carbonated alkali, either in their natural state or when concentrated by evaporation. These springs are rare; but some are found at St. Michael's in the Azores. The water contains carbonate of soda and carbonic acid, and is almost entirely free from earthy substances.

Chalybeate Waters, which are characterized by a strong, styptic, inky taste, and by producing a black colour when mixed with an infusion of gall-nuts. The iron contained in these waters is most frequently in the form of protocarbonate held in solution by free carbonic acid. On exposure to the air, the protoxide is oxidized, and the hydrated peroxide descends, leaving the reddish-yellow deposit ordinarily observed in the neighbourhood of chalybeate springs. Waters of this kind are not uncommon. The most noted in this country are those of Tunbridge, Cheltenham.

Sulphureous Waters contain hydrosulphuric acid, and may easily be recognized by their odour. They also cause a brown precipitate when mixed with a salt of lead or silver. The springs of Aix-la-Chapelle, Harrowgate, and Moffat afford examples of sulphureous waters.

Saline Springs derive their characters from saline compounds held in solution. The salts which are most frequently contained in these waters are the sulphates and carbonates of lime, magnesia, and soda, and the chlorides of calcium, magnesium, and sodium. In a few, potash is found; and Berzelius discovered lithia in the spring of Carlsbad. Among instances of saline springs may be mentioned those of Epsom, Cheltenham, Bath, Bristol, Barèges, Buxton, Pitcaithly, and Toeplitz. Sea-water may be regarded as one of the saline mineral waters. The water of the Dead Sea, however, possesses a far stronger saline impregnation than sea water, as it contains one-fourth of its weight of solid matter. It has a peculiarly bitter, saline, and pungent taste, and its specific gravity is 1·211.

Silicious Waters are very rare, and in those hitherto discovered the silica appears to have been dissolved by means of soda. The most remarkable of these are the boiling-springs of the Geyser and Rykum, in Iceland. (*See* GEYSER.)

MINKS. (*See* WEASEL.)

MINNOW, *min'-no* (Fr., *menu*, small), (*Leuciscus phoxinus* of Cuvier).—A small abdominal malacopterygious fish, belonging to the family *Cyprinidæ*. It is variously termed the minnow, minim, or pink, and is one of the most prettily marked, as well as smallest, of the British Cyprinidæ. The top of the head and back are a dusky olive, mottled, and lighter in colour on the sides; the under surface of the body is white; and a fine rosy pink in summer; the irides and gill-covers silvery; dorsal fine pale brown; pectoral, ventral, and anal fins lighter in colour; the tail being brown and of a lightish hue.

MINT. (*See* MENTHA.)

MINUTE, *min'-ute* (Lat., *minutum*).—The sixtieth part of an hour of time, or the sixtieth part of a degree of a circle. Minutes of time are generally denoted in astronomical works by the letter *m*, and minutes of space by the dash or acute accent, which was first introduced by Pliny. Every minute (1′) is also divided into sixty equal parts, each called a *second* (1″).

MIOCENE, *mi'-o-seen* (Gr., less recent).—A term used by Lyell to denote the "Middle Tertiary" strata. (*See* GEOLOGY.)

MIRABILIS, *mi-rab'-i-lis* (Lat., wonderful).—The Marvel of Peru, a genus of the natural order *Nyctaginaceæ*. The species form highly ornamental border plants. The roots of *M. jalapa* and *longiflora* have purgative properties; those of the first-named species were long erroneously supposed to constitute our medicinal *jalap*. *M. dichotoma* is commonly called the four-o'clock plant, on account of its opening its flowers in the afternoon.

MIRAGE, *me-rahje'* (Fr.)—A term applied to an optical phenomenon very common at sea, especially in high latitudes. It is sometimes also seen on land, especially in Egypt and Persia. The name of "looming" has long been applied at sea to the elevation or apparent bringing near of coasts, mountains, ships, &c.; and when the same phenomenon is accompanied by inversion, it is termed a *mirage*. The appearance presented is very singular, being that of a double image of the object in the air,—one of the images being in its natural position, and the other inverted, so as to give the appearance of a distinct reflection in the water. The mirage is produced when the rays of light are unequally refracted in the lower strata of the atmosphere. The surface of the earth or sea becomes heated, and transmits a portion of its heat to the layer of air lying directly above it, which thus becomes less dense than the superincumbent layers. When rays of light pass from an object in the heated layer, they are bent downward, and thus arrive at the end in such a direction as to make the object appear elevated above its true position. Thus, in the desert, where the surface is level, the mirage takes the form of a lake, deceiving the thirsty traveller with an appearance of cool water and green trees, which vanishes as he approaches nearer, and changes the angle of vision. In the whale-fishery, ships are often seen, and sometimes recognized, at considerable distances by means of the mirage. Captain Scoresby thus recognized his father's ship at a distance of thirty miles. On the evening of July 6, 1881, a beautiful mirage was seen from the east coast of Ireland. Beyond the sea, at an apparent distance of 12 or 15 miles, a long tract of land appeared, covered with green fields, trees, farm-houses, &c. Two rocky islets were distinctly visible in a patch of light, in which many vessels were reflected in an inverted position.

MIST, *mist* (Sax).—The vapour of water rendered visible by the lowering of the temperature of the atmosphere. When the mist is very dense, it is generally called a *fog*. The London fogs, remarkable for their yellow colour, are produced in winter by the condensation by cold of the large quantity of vapour produced by a great city. This condensed vapour is also mixed with smoke, which renders it heavier, and causes it to hang over the valley of the Thames about London. When the vapours in the upper portions of the atmosphere are condensed, and become visible, they are called *clouds*.

MISTLETOE, *mis'-sel-to* (Ang.-Sax., *mistel-tan*).—A genus (*Viscum*) of exogenous parasitical shrubs of the natural order *Loranthaceæ*. There are more than 400 known species, the larger number tropical, and some have showy flowers. The only British species is the Common Mistletoe (*V. album*), which grows as a parasite on many kinds of trees, especially the apple, pear, and hawthorn. It is a common belief that it grows most abundantly on the oak, but in fact it is very rarely found there. It is sometimes met with on poplars, sycamores, limes, and firs. The mistletoe is very plentiful in some parts of the south of England. The stems divide by forking, the flowers are small, and the leaves are of a yellowish-white colour. The white berries forming clusters at the joints of the stalks, are full of a viscid juice, which causes the seeds to adhere to branches, where they take root and germinate; and this juice is used as birdlime. Thrushes are fond of the berries.

MISTRAL, *mis'-tral*.—The north-west wind which prevails on the south coast of France, especially during the winter months. A rapid fall of temperature generally announces its approach, and then the wind comes in sudden gusts, making navigation in the Gulf of Lyons and Valence almost impossible. On land, fruit trees and frequently field crops are greatly damaged. The mistral is supposed to be caused by the influx of cold condensed air from the Alpine and other mountain regions. Locally, it is known as *mistraon* or *mæstral*, and the Italians call it, by a slight but very appropriate perversion of the other names, *mæstro* (the master).

MITE. (*See* ACARUS.)

MIXED RACES.—Marriages between persons of different races, according to ethnological distinctions (*see* ETHNOLOGY), are generally even more prolific than those between individuals of the same clime, complexion, and degree, and the offspring are also prolific—a fact greatly relied on by advocates of the theory of the unity of the human race, as in the lower animals, although hybrids are common, and the offspring of such unions are barren. Even between white people and negroes, with such marked external distinctions, there is no natural impediment to intermarriage, and the production of numerous and healthy children. The most remarkable variety of mixed races exists in the western world, the result of intermarriages between the European, negro, and Indian races, and the subsequent intermixture of the compound varieties. Ethnologists have elaborately investigated this subject, and given a variety of names to the offspring of such unions. A few of those which are most common may be given. The child of a white father and a negro mother is a *mulatto*; of a white father and an Indian mother, a *mestizo*; of a white father and mulatto mother, a *quadroon*; of a white father and mestizo mother, a *creole*; of a negro father and Indian mother, a *zambo*, or *sambo* (from which comes the name popularly, but incorrectly, applied humorously to a negro). In the United States a great objection is exhibited to marriages between the white and black races, "miscegenation," as it is termed.

MOA, *mo'-a.*—The name given by the natives of New Zealand to large birds now extinct, but bones of which are found in river-beds, by the sea shore, in caves, and other places. (*See* DINORNIS.)

MOCKING-BIRD, *mok'-ing* (Fr., *moquer*, to mock).—A bird belonging to the family *Merulidæ*. The mocking-bird is a native of America and the West Indies, and is remarkable for its vocal powers and faculty for imitating the songs of other birds, as well as different noises which it hears. Its voice is very full and strong, besides being musical, and capable of any modulation, to the softest notes; from the clear tones of the wood-thrush it can reach the savage scream of the eagle.

MODULUS, *mod-u-lus.*—In Mathematics, a constant co-efficient or multiplier, by means of which one series or system of quantities can be reduced to another similar series or system.

MOLE, *mole* (Dan., *mol*), (*Talpa Europæa* of Linnæus).—This animal belongs to the family *Talpidæ*, of which it may be taken as the type. The moles are small quadrupeds, having their bodies nearly of a cylindrical form; the neck short and thick; the head tapering to a pointed snout; the fore limbs very short and strong; the fore feet of great breadth, being furnished with remarkably long, strong, and straight claws; the hind feet small, with slender claws; the eyes minute, and concealed by the fur; the tail short and slender, and the hair soft and velvety. Moles possess six incisors in the upper and eight in the lower jaw; and seven grinders above, and six in the lower jaw. The canine teeth are large and angular, being compressed. Their pointed muzzle, strong fore feet, and sharp teeth enable them to make their way underground without much difficulty. The common mole is about five or six inches long, and the colour of its fur is usually black, although the tint varies considerably from that colour down to white. Earthworms form its principal staple of food, although it also feeds on frogs, snails, and small insects. It lives the greater part of its time underground; and it labours incessantly in excavating galleries, up and down which it can run and procure its prey, as well as escape its enemies. It is a native of Great Britain; but another variety of it exists in the Apennines, in Italy.

MOLECULE, *mo'-le-kule* (Fr.)—A term used in Chemistry to signify the smallest conceivable compound particle of a compound body, and may consist of two or more atoms; in other words, molecules are the constituent particles of bodies. "Molecules are the ultimate parts of all compound bodies" (*Tyndall*); thus, a molecule of water consists of two atoms of hydrogen which grasp, and are grasped by, one atom of oxygen. (*See also* ATOM and ATOMIC THEORY.)

Molecular Attraction, Molecular Theories, *mol-ek'-u-lar.*—It is conceived that bodies can be divided into indivisible atoms, each having a definite uniform weight and general character. These ultimate particles are generally in this country called *atoms*, while those are called molecules which consist of two or more atoms. These molecules have an attraction for one another which makes them adhere together. If the specific nature of these molecules were known, and the laws of the forces that retain them, whether these forces be of attraction or repulsion, it is evident that we should have the true key to tell the changes and sequences of the material universe. A number of attempts has been made to construct theories on this ground, sufficiently general to enable the inquirer to avoid restrictive conditions, and at the same time to afford a base for wide and important conclusions. One of the earliest explorers in the field of molecular theories was Boscovich, who asserted that matter did not consist of solid particles, but of mere mathematical centres of forces. Each body is supposed by his theory to be made up of a number of geometrical points, from which emanate forces following certain mathematical laws, in virtue of which the forces become at certain small distances attractive, and at certain other distances repulsive, and at greater distances again attractive. Whewell says, "From these forces of the points arise the cohesion of the parts of the same body, the resistance which it excites against the pressure of another body, and, finally, the attraction of gravitation, which it exerts upon bodies at a distance." Mr. Grove, Q.C., more lately has followed up the subject in his investigations concerning the correlation of the physical forces (which *see*). Important works on the subject are those of Gauss on "Terrestrial Magnetism," and Dr. Simon George Ohm's "Contributions to Molecular Physics." In the latter work, Ohm supposes that ultimate molecules have both *simple* and *polar* powers, and on the ground of this hypothesis, attempts to educe a complete system from which the phenomena of light, heat, and electricity necessarily and harmoniously flow forth. Professor Tyndall has written very lucidly on this subject.

MOLE-RAT.—A genus of (*Spaloa*) of rodent quadrupeds of the family *muridæs*. They resemble moles in general form, but their food is different, consisting of roots and other vegetable substances. They are natives of the south of Russia and some parts of Asia. There are two varieties of this animal at the Cape; one called the sand-mole (*Bathyergus maritimus*), and the other the Cape mole-rat (*B. capensis*), which is called "*Bless Moll*" by the Dutch.

MOLE, WATER. (*See* DUCKBILL.)

MOLLUSCA, *mol-lus'-ka* (Lat.)—A class of animals belonging to the second great division of the animal kingdom, characteristically designated as being without a backbone. Molluscs may be briefly described to be animals covered with a soft, moist skin, mostly forming over the back a duplication, free at the margin, and termed a *mantle*. The head is more or less distinct, is furnished with tentacles, and is often provided with two eyes. The shell is calcareous, mostly univalve; in some this covering is multivalve, in a few internal, and in others absent altogether. The organs of circulation and respiration are generally distinct, and the heart is always aortic. A nervous ring is also around the œsophagus, while the nerves proceed from ganglia, are various in number, and are principally directed to the peripheral parts of the body. Their motions consist principally of contractions in different directions, which produce inflections and prolongations, or relaxations of their various parts; by which means they creep, swim, and seize upon objects, just as the form of those parts may permit; but as the limbs are supported by articulated and solid levers, they cannot proceed rapidly or by leaps; the irritability of most of them is extremely great, and continues for a long time after they are divided. Their skin is naked, very sensitive, and usually covered with a humour that oozes from its pores. No particular organ of smell has been discovered in them, although they possess that sense; it may, however, possibly reside in the entire skin. All the acephala, brachiopoda, cirrhopoda, and part of the gasteropoda and pteropoda are destitute of eyes. The cephalopoda, on the other hand, have them quite as complicated as those of warm-blooded animals; they also possess the peculiarity of being supplied with organs of hearing; and they are the only class in which the brain has been discovered to be inclosed in a particular cartilaginous box. Nearly all molluscs have, more or less, a development of the skin, termed the mantle, as before stated, and this is often narrowed into a simple dish, formed into a pipe, hollowed into a sac, or extended and divided in the form of fins. The *naked mollusca* are those in which the mantle is simply membraneous or fleshy; most frequently, however, it forms in its thickness one or several laminæ, of a substance which is more or less hard, and is deposited in layers, always increasing in extent as well as in thickness, because the recent layers always outedge the old ones. When this substance remains concealed in the thickness of the mantle, it is customary still to apply the term naked mollusca. Generally, however, it becomes so much developed that the animal, when contracted, can find shelter beneath it. In such a case it is then termed a *shell*, and the animal is said to be *testaceous*. The shells are various, and differ in form, colour, surface, substance, and brilliancy. Some are calcareous, while others are horny, and they always consist of matter deposited in layers, and exuded from the skin under the epidermis, like the enamel covering the nails, horns, scales, and teeth of other animals. All modes of mastication and deglutition can be traced in the mollusca. Their stomachs are sometimes simple, at other times multiple, and frequently provided with a peculiar anatomy, while their intestines are variously prolonged. They commonly have salivary glands, and always a large liver, but neither pancreas nor mesentery; several also have secretions which are peculiar to themselves. Their modes of generation vary considerably. Several possess the faculty of self-impregnation; others, although hermaphrodites, have need of a reciprocal intercourse; while many, indeed, have the sexes distinct and separated. Some, again, are viviparous, others oviparous; the egg of the latter are sometimes enveloped with a shell, more or less hard, but sometimes covered with a simple viscosity. These varieties of the digestive and generative processes are found in the same order, and sometimes in the same family. The mollusca, in general, appear to be animals that are but slightly developed, possessed of but little industry, and which are only preserved by their fecundity and vital tenacity. Molluscs convert nearly every substance, both animal and vegetable, into food, which some take in a decomposed state, while others will only eat such substances as are perfectly fresh. Some are terrestrial, while others inhabit only the sea and fresh waters: a few varieties are also amphibious; but this class is much restricted in number. The uses and advantages of molluscs are various. Some supply food to man, while others supply nutritive provender to birds and fishes. Their shelly coverings are also converted into useful articles of commerce, and the celebrated Tyrian dye of the ancients was made from the veins of different shells, termed *purpura*, by the Romans. The molluscs are divided into numerous classes, according to their structure; those possessed of a shell with one valve are termed univalve mollusca, and are furnished with a distinct head; from which circumstance they are called *encephalous*. These are divided into three classes, the first of which is termed:—1. *Cephalopoda*, or *cuttle-fishes*. These have their feet, or, strictly speaking, arms, attached to the head, forming a circle round the mouth. (*See* CUTTLE-FISH.) 2. The next class is the family *Gasteropoda*, or *snails*, which Cuvier divides into several orders or divisions, according to the structure of the gills; as the *Pulmonaria*, *Nudibranchiata*, *Inferobranchiata*, *Tectibranchiata*, *Heteropoda*, *Pectinibranchiata*, *Scutibranchiata*, and *Cyclobranchiata*. 3. The third class of the univalves is termed *Pteropoda*, which swim in the sea with a pair of fins that extend outwards from the sides of the head. The subdivision *Clio* of Linnæus, of this class, is the type of the whole: the family Pteropoda are mostly hermaphrodital. The *Acephalous*, or bivalve molluscs, are divided into two classes—1, the *Conchifera*, and, 2, the *Brachiopoda*, both of which classes have been united into one order by later naturalists. The respiratory apparatus of these is externally situated, and is placed either between the mantle and the body in the form of plates, or in the the substance of the mantle itself. Besides the several classes which have been catalogued, there is yet another, called the *Tunicata*, which are destitute both of head and shell.

Molluscoids.—A group of the mollusca, from which they are distinguished by a very low development of the nervous system. They have only a single ganglion, which gives off nerves in various directions. They also differ from the true mollusca by reason of their being propagated by germination. They are subdivided into various species, of which the *Tunicata*, which are destitute of both head and shell, may be taken as a specimen.

Fossil Mollusca.—The remains, petrified into stone, of molluscs long since dead. The hard shell of these creatures enables them to be long preserved, and they are the most frequently found of all organic remains in the fossiliferous rocks. (*See* GEOLOGY, FOSSILS, &c.)

MOLUCCA BERRIES. (*See* ELÆOCARPUS.)

MOLYBDENUM, *mo-lib'-de-num* (Greek, *molubdaina*).—A somewhat rare metal found in nature, principally as the bisulphide, in Bohemia and Sweden. It is also found oxidized in combination with lead, as molybdate of lead. The metal is obtained by roasting the bisulphide in excess of air, and mixing the remaining molybdic acid into a paste with oil and charcoal. If this be exposed to the heat of a smith's forge, it is reduced to the metallic state as a white, brittle, difficultly fusible mass. It forms three oxides—the protoxide, deutoxide, and teroxide. The two former are possessed of basic properties, and form salts; the latter is molybdic acid, the only important salt of which is the phosphomolybdate of soda, which is a test for ammonia. The sulphomolybdates of the alkalies are beautiful iridescent metallic salts, rivalling in brilliancy the rosaniline and muroxide compounds. Its other compounds are unimportant.

MOMENTUM, *mo-men'-tum* (Lat.)—A term applied to express the quantity of motion in a moving body; in other words, the impetus of the same. The momentum is always equal to the velocity multiplied into the weight. (*See* IMPETUS.)

MOMORDICA, *mo-mor'-di-ka.*—One of the 60 genera into which the *Cucurbitaceæ* or Gourd family of plants is divided. There are three species, but little known.

MONAD, *mo'-nad* (Gr., *monas*, a unit).—A term given to the simplest kind of minute animalcules.

MONARDA, *mo-nar'-da* (after Monarda, a Spanish physician).—A genus of the natural order *Labiatæ*. The species *M. punctata*, commonly called horsemint, is used medicinally in the United States. This herb resembles the ordinary mints in its properties, but it is more stimulating. *M. fistulosa* is said to be febrifugal. The leaves of *M. didyma* and *purpurea* are used as tea in North America under the name of Oswego tea; the flowers of the former are said to contain the same colouring principle as cochineal.

MONESIA BARK, *mon-e'-sjar.*—The bark of *Chrysophyllum glycyphlœum*, a tree found in the south of Brazil. A substance called *monesia* is made from it, which is sometimes used in medicine as a stomachic and alterative.

MONGOLIAN RACE, *mon-go'-le-an*, is one of the great ethnological divisions of the human race. (*See* ETHNOLOGY.)

MONIMIACEÆ, *mon-im-e-ai'-se-e.*—A small natural order of *Dicotyledones*, sub-class *Monochlamydeæ*, consisting of eight genera of fragrant trees or shrubs, chiefly natives of South America, but found also in Australia, Java, the Mauritius, and New Zealand. The flowers generally resemble those of *Atherospermaceæ* (which *see*); but they differ in always being unisexual; in the longitudinal dehiscence of the anthers, and in the absence of feathery styles to the fruit.

MONITOR, *mon'-e-tor* (Lat., one who warns).—A genus of large lizards having teeth in both jaws, and none on the palate. The greater part have the tail compressed laterally, as an adaptation to their aquatic habits. The first of the two distinct groups into which the genus is divided bears the name of Nilotic monitors, their chief characteristics being numerous small scales upon the head and limbs, and a keel above the tail, formed of a double range of projecting scales. The second group carries angular plates upon the head, whilst the body and tail carry large rectangular scales. The monitors are found in most parts of the world, and the fossil remains, of species larger than any at present in existence, have been discovered in Europe. Their name is said to be derived from their making a whistling sound, as a warning of the approach of crocodiles and alligators, whose haunts the monitors frequent.

MONKEY, *munk'-e* (Ital., *monicchio*).—A genus of four-handed *mammalia*, belonging to the family *Simiadæ* (which *see*). Properly speaking, the term only includes those members of this large family which have long tails and cheek-pouches, the term *ape* being given to those which have no tails and no cheek-pouches (*see* APE), and the term *Baboon* to those which have short tails and faces something like a dog's. Popularly, however, the term monkey is applied to all the *Simiadæ*. There are no other animals which, in anatomical structure and general appearance, exhibit such a resemblance to man, and this is notably the case with regard to some of the larger apes. But there are several very important points of difference: for instance, they have not two hands and two feet, but rather *four hands;* consequently it is a great matter of difficulty for them to walk erect, and they very rarely do so. Another point is that they show no latent power whatever of being able to imitate human speech—their chattering being quite a different thing altogether. It is also quite a question as to whether their intelligence is in any way superior to that of the dog or the elephant, while the manner in which the head is fixed to the vertebral column is also quite different. (*See also* APE, BABOON, GORILLA, OURANG-OUTANG, QUADRUMANA, and SIMIADÆ.)

Different Kinds of Monkeys.—The *sapajous* are very active, climb well, and by the aid of their tail, which is as good as another hand, they can spring from tree to tree in the vast forests of South America with inconceivable rapidity and agility. The fore-hands, however, are not so perfectly organized as those belonging to the monkeys of Africa, the thumb being longer and more on a line with the other fingers. The facial angle of the *sapajous* is 60°, which forms a marked contrast to others of the species. They are small in size, and very playful. Foremost amongst them may be placed the *weeper* (*Cebus Apella*). Its fur is of a rich olive colour, inclining to golden on the lighter parts. There is also the *horned sapajou* (*Cebus fatuellus*), the *large-headed sapajou* (*Cebus monachus*), and more than fifteen or sixteen other species.

The *Spotted* or *Diana Monkey* (*Cercopithecus Diana*), a native of Congo and Guinea, and one of the most lively and playful of the whole tribe. It has a long white beard, and the upper parts of the body are of a reddish colour, marked with white specks, and the tail is about as long as the body.

The *Green Monkey* (*Cercopithecus sabæus*) is one of the most abundant of the group, and is oftener seen in a state of captivity. It is a native of the Cape de Verde Islands and of the continent of Africa. In its disposition it approaches the long-armed apes, although it is more lively and playful. The colour is greenish-yellow above, arising from the hairs being arranged according to different shades of yellow and black; but the colour is more of a dark grizzled appearance on the sides of the body and on the sides of the limbs, which becomes gradually darker towards the hands. The face, ears, and naked part of the hands are of a jet black; the former is of a triangular shape bounded above the eyes by a straight line of stiff, black hairs, and on the sides by spreading tufts of light hairs, with a yellowish tinge, meeting in a point beneath the chin. The neck and chest and the under parts of the body have a yellowish tinge, and the inside of the limbs is greyish in colour. The length of the head and body is about from sixteen to eighteen inches, while that of the tail is somewhat more.

The *Proboscis Monkey*.—One of the most peculiar of the monkey class is the *Nasalis larvatus* of Geoffroy, which is distinguished by the extraordinary elongation of its nose, which gives it the most grotesque appearance. This nose is about four inches long; the body is unshapely, protruding in front, like the ourangs; the arms are of considerable proportionate length, like the gibbons; while, like the howling monkeys, it possesses a large guttural sack; the presence, also, of a very long tail and naked callosities, combine, with the protrusion of the nasal organ, to give the *proboscis monkey* the most eccentric and peculiar appearance of the whole tribe. It is about three feet in height, and is a native of the island of Borneo.

The *Red Monkey* may next be mentioned, as it is one of the oldest known to naturalists. It is a native of Senegal. The length of the body is about a foot and a-half, or one foot four inches, while that of the tail is nearly equal. All the upper parts are of a brilliant reddish fawn-colour, which is shaded into a pale greyish tinge on the arms and legs, while the face, cheeks, breast, and under surface of the body are pure white; a band of black hair crosses above the eyebrows, and there are two lines of the same colour upon the upper lip, in the shape of a moustache, which tend to give this monkey a most peculiar appearance.

The *Entellus Monkey* (*Semnopithecus entellus* of F. Cuvier) is another variety; but it is little known in European collections. It is a native of the Indian Archipelago, and of some parts of the Asiatic continent. According to Cuvier, the height of the *Entellus monkey* is generally about one foot five inches, and the length of the tail two feet.

The *Negro Monkey* (*Semnopithecus maurus*) is a native of Java and Sumatra; is somewhat larger than the variety last described, the length of the body being about two feet and a-half, and that of the tail nearly equal. According to Doctor Horsfield's description, this class of monkey inhabits the extensive forests of the Spice Islands, and associates in numerous bands or societies, numbering more than fifty at a time, and is pursued by the natives for the sake of the fur. In these pursuits, which are regularly organized and prepared beforehand by the chiefs of the various tribes, the animals are attacked with cudgels and stones, and are destroyed in large numbers. The skins are then prepared by a simple process, which the natives learned from Europeans, and are exported. The fur is of a jet-black colour, covered with long, silky hairs.

The *Simpai* (*Semnopithecus melalophos* of F. Cuvier) is also a native of Java and Sumatra, and is remarkable from the flatness of the face and the development of the facial angle.

The *White-eyelid Monkey* (*Cercopithecus fuliginosus* of Geoffroy) is distinguished by the peculiar colour of the eyelids; they are of a clear, greyish white, but with a dead chalky line. The hair is soft and fine to the touch, and in the upper parts is sooty black, which is even darker on the hands, but which generally shades into a yellowish tint on the breasts, belly, and inside of the thighs, and on these parts the thin coating of hair plainly shows the skin, which is of a very pure flesh-colour. (*See* also APE, GORILLA, BABOON, OURANG-OUTANG, QUADRUMANA, and SIMIADÆ.)

MONKEY-APPLE. (*See* CLUSIA.)

MONKEY-POT. (*See* LECYTHIDACEÆ.)

MONKSHOOD. (*See* ACONITUM.)

MONK'S RHUBARB. (*See* DOCK and RUMEX.)

MONNINA, *mon-ni'-na* (in honour of Monino, a Spanish botanist).—A genus of the natural order *Polygalaceæ*. The bark from the roots of *M. polystachya* and *salicifolia* is especially remarkable for the presence of a saponaceous principle; it is used in Peru as a substitute for soap, and for cleaning and polishing silver. This bark is, moreover, said to be a valuable medicine in diarrhœa and similar diseases.

MONOCHLAMYDEÆ, OR APETALÆ, *mon-o-klam-id'-e-e* (Gr., *monos chlamus*, a short cloak).—A sub-class of *Dicotyledones*, comprising those plants of the division *Angiospermia* in which the flower has a calyx only, or is without both calyx and corolla. Fifty-eight natural orders are included by Professor Bentley in the sub-class.

MONOCOTYLEDONES, *mo-no-ko-til-e'-donez* (Gr., *monos*, single; *kotuledon*, a cotyledon).—One of the two great classes into which the phanerogamous or flowering plants are divided. It agrees with the *Endogenæ* of some botanists, and includes the *Endogens* and *Dictyogens* of Lindley. (*See* BOTANY.)

MONODON. (*See* WHALE.)

MONŒCIOUS, *mon-e-shus*.—A term used to denote those plants which have the stamens and pistils in different flowers, but on the same plant, as the hop, beech, box, hazel, &c.

MONOMANIA, popularly speaking, means madness on one subject. It is often applied when one faculty or class of faculties, or one emotion or propensity, becomes diseased or morbidly increased, and it is often found that the patient is suffering from physical disease or structural alteration. Thus, the morbid development of "cautiousness," amounting to a perpetual state of panic or dread of death, is often associated with certain diseases of the heart. (*See* INSANITY.)

MONOSTOMA, *mon-os'-to-ma*.—A genus of Trematoid worms which have only a single sucker.

MONOTREMATA, *mon-o-trem'-a-ta* (Gr., *monos*, single; *trema*, an opening).—A term used to denote certain creatures which, though belonging to the mammalia, present certain bird-like characteristics. There appear to be only two families, the Echidna (which *see*) and the Ornithorhynchidæ (*see* DUCK BILL). In these creatures the intestinal, the urinal, and the generative canals all open into one passage—the cloace—as in birds, hence their name. (*See* also CLOACA.)

MONOTROPACEÆ, *mo-no-tro-pai'-se-e* (Gr., *monos*, one; *tropeo*, I turn;—the flowers are turned one way).—The Fir-rape family, a natural order of *Dicotyledones*, sub-class *Corolliflorœ*, consisting of parasitic plants with scaly stems, found growing on firs. There are six genera and ten species.

MONSOON, *mon-soon'* (Arabic, a season).—The name given in Physical Geography to the periodical winds of the Indian Ocean. From a very early period these winds have attracted the attention of the navigator, as, by taking advantage of their regular blowing, a quick and easy journey can be depended upon. Monsoons blow with the greatest force and with most regularity between the east coast of Africa and Hindustan. A north-east wind blows over this part of the ocean when the sun is in the southern hemisphere, and a south-west when it is in the northern hemisphere. When the sun crosses the equator, the winds are variable, and gales, hurricanes, calms, and thunderstorms occur. The north-east monsoon blows from November to March; while the south-west monsoon, which does not extend south of the equator, blows from the end of April to the beginning of October. The changes are known to sailors as the "breaking up of the monsoons." Monsoons are probably modifications of the trade winds. When the sun is north of the equator, the north of Africa and the south of Asia are greatly heated, and there is a rush of air from the Indian Ocean, South Africa, and Australia, and by the revolution of the earth, an eastern motion is imparted, the result being the south-west monsoon. In our winter, when the sun is south of the equator, the air-currents come from the north, and there is a north-east monsoon.

MONTH, *munth* (Ang.-Sax., *monath*).—Originally understood as the period of time, which the moon takes to revolve round the earth, but now having other significations.

Lunar Month.—The period taken by the moon to revolve round the earth—about 29 days, 13 hours. The ancient Romans used lunar months, and made them alternately of 29 and 30 days.

Solar Month.—As the solar and lunar revolutions do not correspond with each other, by following the lunar mode of reckoning, the seasons of the year would be found to fall back, so as in 34 years to effect a complete change from summer to winter; hence it was necessary to regard the month as the twelfth part of the solar year, being 30 days, 10 hours, 29 minutes, 5 seconds: this is called the solar month.

Anomalistic Month.—The mean period of the moon's revolution round the earth from perigee to perigee of her orbit—27 days, 13 hours, 18 minutes, 36 seconds.

Sidereal Month.—The period in which the moon, as seen from a fixed star, appears to perform its revolution round the earth. In other words, the period in which the moon passes through the twelve signs of the zodiac. Its length varies, but the mean is slightly over 27 days.

Synodic Month.—This period exceeds a sidereal month by about 2 days, because when the moon, starting from any assigned position, has completed her revolution, the earth has also been moving round the sun, and the moon has several degrees of space still to travel before regaining her position relatively to the sun that she had when she began the revolution.

MOON, *moon* (Sax., *mona*), the satellite of the earth. Next to the sun, the moon is to us not only the most conspicuous, but the most interesting of the heavenly bodies. Its mean distance from the earth is about 238,833 miles, which is a short distance when compared with the interval which separates us from any other globe. The diameter of the moon is 2,165 miles; consequently the hemisphere which we see is only equivalent to a fourteenth of the terrestrial hemisphere. The surface visible is indeed not more than twice the size of Europe, but on it there are unmistakable indications of vast cosmical forces. In density, the moon is little more than half that of the earth, and at its surface, gravity is not more than one-sixth of our terrestrial gravity; if, therefore, explosive or upheaving forces exist there, and are independent of the size of the globe, we should expect to find disruptions on its surface much exceeding in comparative magnitude any of the disruptions that have occurred in the most rugged places of the earth. Again, the moon turns towards the earth always the same face: this is equivalent to the fact of her rotation in space round an axis in the same time that she performs her monthly revolution. It revolves round the earth from west to east in a period of about 29½ days (*see* month), and consequently accompanies the earth on her path round the sun. The light by which the moon is visible to us is the illumination which she receives from the sun. The shape of the moon, like that of all the celestial bodies, is nearly spherical.

Phases of the Moon.—In revolving round the earth the moon presents to us different phases or appearances. This is caused by the fact that although one half of her surface is always illumined by the sun, the whole of this illuminated portion is not always visible to us, because the moon is constantly changing her position by encircling round the earth, and also rotating on her axis. Thus when the moon is between the earth and the sun no portion of her illuminated hemisphere can be seen by us; when she gets on the other side of the earth, and the earth is between the sun and the moon, then the whole of her illuminated portion can be seen, and it is what we call *full moon*. Between these two phases the moon appears sometimes as a semi-circle and sometimes as a crescent.

Physical Features.—It is scarcely possible to conceive a more remarkable contrast than that between the appearance of the moon to the naked eye and the forms she presents to the telescope. Instead of a plain bright surface, we discover a body of the strangest character, broken by irregularities, which present few analogies with the mountainous regions of the earth. In one region may be seen vast mountains throwing their long shadows on a plain; while in others are various pits or caverns, as deep as Mont Blanc is high, often crowded together with the compactness of a honeycomb. Many careful maps of the moon's surface have been made at various times. The lunar plains were formerly considered seas, and the names then given to them, as the Sea of Serenity, the Sea of Storms, &c., are still used to designate them; whether or not they were seas ages ago we cannot say, but it is certain that there is no water in them now; although it is impossible not to be struck with the similarity between their outlines and the general aspect of our terrestrial system of oceans. The lunar plains are also distinguished by great variety of colouring, giving the appearance of the formation of successive shores, probably by the gradual retirement of an ocean. The mountain forms in the moon are of three kinds.—First, a number of perfectly isolated peaks, or sugar-loaf mountains, unconnected with any group or range whatever. The finest instance of these is *Pico*, a very brilliant rock, about half as high as the loftiest of the Alps, which towers almost precipitously north of the crater *Plato*. Second, mountain-ranges or chains, which do not occur frequently: their usual position is that of a curvilineal but broken skirt of the greater flats or plains. Some of these masses attain a height of from eighteen to twenty thousand feet. Third, lunar craters. The objects thus called may be termed the characteristic feature of the moon's disturbed region. Not less than three-fifths of the moon's surface are studded with vast caverns, or rather circular pits, penetrating into its mass, and generally girded round at the top with a wall of rock, which is sometimes serrated and crowned by peaks. These pits vary in diameter from fifty or sixty miles to the smallest space visible, probably about five hundred feet. It would seem that on the moon's surface there is no atmosphere, or at least none dense enough to refract the rays of light. There is also, as stated before, no water on its surface, and consequently no animal similar to those which exist on the earth. There is no appearance of vegetation, or of the variations which accompany the seasons. The hemisphere which we can see is a vast rugged desert, desolate and void of life. (*See* ACCELERATION OF THE MOON, LUNAR ECLIPSE, LUNAR EVECTION, METONIC CYCLE, LIBRATION OF THE MOON).

MOONJAH, MOONYAH OR MUNJAH (*Saccharium Munja*).—A tall, tough grass of the same genus as the sugar-cane. It is a native of India, and grows in great abundance on the banks of the large rivers. A strong fibre is obtained from the leaves, and twisted into rope.

MOONSTONE. (*See* FELSPAR.)

MOORFOWL, sometimes called *Red Grouse*, and in books of Natural History denominated *Red* and sometimes *Brown Ptarmigan* (*Lagopus*

Scoticus).—A wild bird found on the moors of Scotland and north of England, and commonly spoken of as the *Grouse* (which *see*).

MOORHEN. (*See* GALLINULE.)

MOOSE-DEER. (*See* ELK.)

MORA, *mo'-ra.*—A genus of the natural order *Leguminosæ*. *M. excelsa*, a large tree flourishing in Guiana, furnishes the mora-wood, which is now largely employed for shipbuilding.

MORACEÆ, *mor-ai'-se-e.*—A natural order of *Dicotyledones*, sub-class *Monochlamydeæ*. Trees or shrubs with a milky juice. The order includes about 22 genera, and nearly 200 species. They are natives of both hemispheres, and are found in temperate and tropical climates. From the milky juice of some, caoutchouc is prepared. The fig-tree and mulberry-tree belong to the order. (*See* FICUS and MORUS.)

MORAINE. (*See* GLACIER.)

MORBID APPETITES.—Desires which, though possibly natural in themselves, are exaggerated to such a degree as to become unhealthy and unnatural—thus there is the hunger which attends marasmus (which *see*), and the thirst, and frequently the hunger also, which accompanies diabetes (which *see*). Another class are those desires for unnatural food, such as lime, grass, stones, and even foul garbage, &c.

MORCHELLA, *mor-kel'-la*, also known as MOREL.—A genus of *Fungi*. *M. esculenta*, the edible morel, is much prized by cooks as a flavouring agent. In England it is generally employed in a dry state, being thus imported from the continent. It is found in greatest abundance in places where trees have been burned, and in Germany the practice of burning down masses of forests for the sake of future morels once became so common that it was necessary to suppress it by law.

MOREL. (*See* MORCHELLA.)

MORETON BAY CHESTNUT (*Castanospermum Australe*).—A large tree indigenous to Queensland, of the natural order *Leguminosæ*. It frequently attains the height of 100 feet, and has far-stretching branches, and long bunches of red and yellow flowers. Its seeds are very much like chestnuts.

MORINDA, *mor-in'-da.*—A genus of the natural order *Cinchonaceæ*. The roots of *M. cetrifolia* and *tinctoria* are used in India and other parts of Asia for dyeing red. They have been occasionally imported into this country under the names of *Madder*, *Munjeet*, and *chayroot*; but such names are improperly applied.

MORINGACEÆ, *mor-in-gai'-se-e.*—The *Moringa*, or Ben-nut family, a natural order of *Dicotyledones*, sub-class *Calcifloræ*. The order contains but one genus; viz., *Moringa*, which consists of four species, natives of India and Arabia. The root of *M. pterygosperma* resembles that of horseradish in taste and odour, and has been used as a stimulant and rubefacient. A kind of gum resembling tragacanth exudes from the bark when wounded. Its seeds are called ben-nuts in this country; *pois quéniques* in France. They yield a fixed oil (oil of Ben), which is sometimes used by painters, and also by perfumers and match manufacturers.

MORMYRIDÆ, *mor-mi'-ra-de.*—A family of fishes found only in the African rivers, and allied to the *Esocidæ*, or pikes. They are known in Egypt by the name *Mizdeh*, and are frequently found sculptured on ancient Egyptian monuments.

MORMYRUS, *mor'-mi-rus.*—The sharp-nosed mormyrus is one of the largest and most edible fishes caught in the Nile. (*See* MORMYRIDÆ.)

MORPHIA, *mor'-fe-a* (from Gr., *morpheus*, the god of sleep).—The most important of the opium alkaloids (which *see*).

MORPHOLOGY, *mor-fo'-lo-gy*, metamorphosis of organs (which *see*).

MORSE. (*See* SEAL.)

MORTIFICATION, *mor-tif-e-kai'-shun* (Lat., *mors*, death, and *facio*, I make).—A term in Medicine used to denote the death of any tissue. (*See* GANGRENE.)

MORUS, *mor'-us* (Gr., *moron*, a mulberry).—The Mulberry, the typical genus of the natural order *Moraceæ*. The fruit of *M. nigra* is our common mulberry. The leaves of this species, as well as those of *Morus alba*, white mulberry, and of others, are in common use as the staple food of silkworms. *M. nigra* is supposed to be identical with the sycamine tree of the Bible.

MOSOSAURUS, *mos-os-aw'-rus*, or Meuse Lizard.—A genus of huge, extinct marine lizards, remains of which have been found at Mæstricht, also in the chalk hills of Sussex, and the cretaceous beds of North America. This animal was supposed to have been nearly 30 feet long.

MOSQUITO, *mos-ke'-to.*—A troublesome little insect, resembling the gnat, and belonging to the family *Culicidæ*. It is a native of the West Indies, the American continent, South Africa, and India. The common mosquito (*Culex mosquito*) is about the same size as the gnat, and possesses a sucker, with five sharp-pointed needle-like organs, with which it pierces the skin and sucks the blood. The mosquito seldom appears in the daytime; but at night, in the tropics, when the unhappy traveller endeavours to sleep, the tantalizing little insect generally succeeds in banishing all idea of repose, both by its power of suction as well as the continuous buzzing sound made by its wings.

MOSSES. (*See* MUSCI.)

MOTH, *moth*, (Sax., *mogthe*).—The common name of all insects belonging to the family of *Lepidoptera*, which fly in the evening and at night. Formerly they composed the genus *Phalæna* of Linnæus. They were then relegated to the sections *Nocturna* or *Crepuscularia* of the order *Lepidoptera*, but a later and more scientific distinction, however, calls those *butterflies* which have club-shaped antennæ, and *moths* those which never have their antennæ club shaped, but varied formed. Hence they are classed *Heterocera*, or varied horned. There are many genera and species. The moths are well known for their habit of destroying clothing and furs, in which they can hardly be stopped, no matter what remedies are adopted; particularly in tropical climates. The *Tinea sarcitella* attacks woollen clothes; the *Tinea pellionella* furs; the *Tinea flavi-frontella* damages collections of natural history, while the *Tinea granella* commits great havoc amongst corn and grain. The damages caused to clothes are, however, chiefly owing to the caterpillar, which begins to form a nest as soon as it has left the egg. In order to effect its object, it first spins a thin coating of silk round its body ; it then cuts filaments of thread or cloth from the garment on which it has located itself, and applies the pieces to the outside of its case, which it never leaves until it has developed itself into a small nocturnal moth, of a silvery grey colour. Turpentine, camphor, and tobacco will generally keep off these troublesome intruders. (*See* LEPIDOPTERA, INSECT TRANSFORMATIONS, APPLE-MOTH, TIGER-MOTH, EMPEROR-MOTH, DEATH'S-HEAD, HAWK-MOTH, &c.)

MOTHER CAREY'S CHICKENS.—A familiar name given by sailors to the various kinds of birds known more widely as the STORMY PETREL (which *see*.)

MOTHERWORT, *muth'-er-wurt* (*Leonurus Cardiaca*).—A perennial wild plant, not very common in Great Britain, but sometimes found in hedges and waste places. It grows to the height of about 3 feet, and has a branched stem with stalked leaves, the lower ones being 3-lobed. Between the leaves are crowded whorls of reddish-white flowers, which have a strong and disagreeable smell.

MOTION, LAWS OF, *mo'-she-on* (Lat., *motio*).—Those laws which govern the continued and successive change of place of various bodies ; in other words, their motion. The first law of motion may be thus described:—1. A body always remains in a state of rest, or of uniform motion in a straight line, until it is made to change its state on account of the action upon it by some external force. 2. This change of motion is proportional in an exact ratio to the force impressed, and is produced in the same straight line in which the opposing force acts. 3. Action, and consequently reaction, are always to be estimated in the same right line, and are equal in opposite directions. Motion once begun would be continued for ever, were it not for the interruption of external causes, the power of gravitation, and many other circumstances which affect it relatively and apparently. *Equable motion* may be briefly stated to be the effects of a single stroke or impetus given to a body ; as the momentum imparted to a ball discharged from the mouth of a cannon by a charge of gunpowder. (*See* GUNNERY.) *Accelerated motion* is produced by a constant application of power or impulse to a body which has been in a state of rest. (*See* GRAVITATION.) To sum up our remarks, force is not required for the maintenance of motion, but only for its change, that is, for producing, in the first place, a change of state from rest to motion, or from motion to rest ; secondly, a change in the velocity of motion, either by accelerating or retarding it ; or thirdly, a change in its direction, by bending it upwards or downwards, to the right or to the left. Not only such bodies as are at rest, but also such as are performing uniform rectilinear motion, may thus be regarded as being in a state of equilibrium (*see* FORCES) ; for it is only while their velocity or direction is changing, that is, while they are being accelerated, retarded, or moving in a curve, that the forces acting on them can be unbalanced, or can produce a resultant pressure ; and as long as this pressure remains unbalanced, the motion will continue changing in velocity, in direction, or in both ; because, whenever it becomes straight and uniform, the resultant of all the forces acting on the body will be equivalent to *nil*, or, in other words, the body will not be subject to any unbalancing force. Hence, the dynamical effect of force being a change of motion, a continued force must produce a continuous change, whether in velocity or direction. The simpler effect of a sudden change of velocity, or an angular deflection, can only be produced by an instantaneous exertion of force, or an impact, as it is termed. (*See* IMPACT.) The ancient philosophers had many peculiar and erroneous impressions with regard to the laws of motion, but their original ideas seemed to be the guiding-points in the investigations of the moderns. Galileo modelled some of the first theories, but we are indebted to Sir Isaac Newton for the first real investigation of the laws of motion.

Perpetual Motion.—A machine which, once set in motion, *would never stop of itself*. Many vain attempts to discover such a machine have been made, and much time has been lost in the endeavour, but while pursuing this myth, other useful things have been invented, and the knowledge of the laws of motion increased. The planets are perpetual motion machines in their rotations on their axes, and any particle of matter once in motion, and unstopped by any other matter, is a perpetual motion. If a wheel on an axle could be deprived of friction, and inclosed in a permanently air-tight and perfectly exhausted receiver, it would, when once in motion, be a perpetual motion. But as long as any friction or resistance, however small, is perpetually retarding the motion, it is obvious that the velocity, if maintained, must be indebted to some external moving power.

MOTIVE POWER, *mo'-tiv* (Fr., *motif*).—A term applied to the whole power or force acting on a body, or any quantity of matter, so as to produce motion. (*See* MOTION, LAWS OF.)

MOUFFLON, *mu'-flon*.—A member of the sheep family found in Corsica and Sardinia, and known generally by the name of *Ovis musmon*. It inhabits mountainous regions. The head is long, with the muzzle compressed, and the nose somewhat raised ; the horns of the males are large, long, and triangular, bending with an arch, which constitutes more than half a circle ; the ears are moderately large, and are erect and acute ; the general tint of the body is yellow, tending to a chestnut or ash-colour, which is deepest on the neck and lighter on several parts of the back and under-surface of the body. The moufflon is provided with long hair, besides wool, and it is to this hair that the gradations of colour are due. The female is distinguished from the male by the absence of horns. The moufflons are very gregarious, going about in herds composed of more than a hundred, which herds are generally placed under the leadership of some old and courageous male.

MOULD, OR MOULDINESS, *mold*.—The popular name for the minute fungi which grow on both animal and vegetable substances, when in a decaying or morbid state. These fungi are so small that they require a microscope to reveal their characteristics, when it will be found that they usually consist of a web of threads from which rise many short stems. Dryness is the only reliable prevention of mould. (*See* MOULD.)

MOULTING, *molt'-ing*.—The periodical throwing off of certain outside structures, such as the skin in the case of serpents and frogs, the shells in crabs, the hair in certain mammals, and the antlers in deer, &c. ; but more particularly the term is applied to the casting off and renewal by birds of their feathers.

MOUNTAIN, *mown'-tain* (from Lat., *mons*, a mountain).—A name given to those great elevations above the earth's surface, which extend in various degrees over the whole globe. Any mountain of small dimensions is termed a *hill*, especially when it rises above the plain by almost insensible degrees. There are various parts in a mountain, which it is as well to observe; for we have the *base*, the *sides* or *declivities*, and the *top* or *summit*. When the summit of a mountain is detached, so to speak, from the general mass, by assuming all at once a very steep ascent, it is called a *peak*; such as the *Pi-du-Midi* in the Pyrenees, the *Pic Blanc* in the Alps, near Mount Rosa, and the peak of Teyda in the island of Teneriffe. Every flat summit is termed a *plateau*, while a rounded one is called a *drove* or hummock. The intervening space between two chains of mountains is termed a *valley*; and this is said to be of the first class when it serves as the basin of a large river. The lateral subdivisions which mountain-chains frequently exhibit, and which form smaller valleys leading into the principal one, bear the name of branches. An offset is a series of smaller mountains which detach themselves from the principal chain, receding from it in a direction almost parallel. If this offset be of small extent, it is termed a spur, while the name of crest is applied to the upper ridge, whether of a branch, an offset, or a spur. If we regard the declivity of a mountain as a plane surface joining the top and bottom, it is easy to determine its inclination with respect to the horizon. The inclination is the more or less accute angle made by the horizontal plane drawn through the foot of the mountain with the plane which we have just defined. The inclination of the northern declivity of the Pyrenees is from 3° to 4°; that of the southern declivity of the greater Alps is only 3¾°. Notwithstanding this circumstance, it is necessary, even in following the ridge of a branch, to mount much steeper slopes. Even a slope between 7° and 8° is very considerable; in fact, it is almost the maximum for vehicles. In France, the regulations are that the great roads shall never exceed an inclination of 4° 46'. An inclination of 15° can hardly be overcome by animals encumbered with a load, while man himself cannot climb a slope of 35° if the ground be composed of rock, or is too hard to allow steps being formed in it. The sea-coasts are generally the lowest part of a country that rises gradually, and, consequently, the centre of a continent contains the loftiest mountains. (*See* PHYSICAL GEOGRAPHY.)

MOUNT ST. BERNARD DOG, *mownt-saint-ber'-nard*.—This large dog, named by some naturalists the Alpine spaniel, presents the characters of a breed between the Newfoundland dog and mastiff, and is well known from the fact of its being employed by the charitable houses of monks in the Alps to rescue travellers who have been buried in the snow, or have lost their way amongst the mountainous regions around them. The Mount St. Bernard dogs are characterised as possessing nearly a larger amount of sagacity, approaching to reason, than any of the varieties of the canine race. Although the unfortunate traveller whom they go out to rescue may lie fifteen or twenty feet beneath the snow, yet these animals at once take up the scent, and scratch away at the snow, all the time continuing a hoarse bark, which can be heard more than a mile distant, and which brings the monks to the rescue. There is another variety which performs nearly as useful services, and which is more strictly allied to the Molossian breed,—it is termed the smooth Alpine spaniel. (*See* DOG.)

MOUSE. (*See* MICE.)

MOUTH, *mowth* (Sax., *muth*).—The aperture in the head of an animal by which he gives utterance, and receives his food. In a more general sense, the mouth consists of the lips, the gums, the insides of the cheeks, the palate, the salival glands, the uvula, and tonsils.

MOVING-PLANT.—The common name of the *Desmodium gyrans*. It belongs to the natural order *Leguminosæ*, sub-order *Papilionaceæ*, and is a native of India. Like some other species of the same genus, it is remarkable for the spontaneous motion of the leaves. The lateral leaflets are in constant motion, being elevated by a succession of little jerks, till they meet above the terminal leaflet, and then moving downwards, by similar jerks, to the leaf-stalk. Sometimes one leaflet is in motion, and the other at rest. Sometimes a few may be seen moving, whilst there is a partial cessation in the other leaves of the plant. Nothing for certain is as yet known as to the cause of these movements.

MUCOR, *mu'-kor* (Lat., mouldiness).—One of the genera of *Fungi*, which form the various kinds of *mould* on bread, cheese, preserves, paper, &c.

MUCOUS MEMBRANE, *mu'-kus* (Lat.) —In Anatomy, the membranous substance which lines all those internal passages and cavities of the body which are exposed to contact with the air, or by which foreign substances are taken into the body or eliminated from it. These membranes are soft, velvety, and extremely vascular. They are distinguished as lining the digestive, respiratory, and genito-urinary passages. In each of those parts they present some slight modifications, adapted for special functions.

MUCUNA, *mu-ku'-na* (*mukuna guaca*, the Brazilian name of one species).—A genus of papilionaceous *Leguminiosæ*. The hairs covering the legumes of the species *M. pruriens* and *prurita* are used as a mechanical anthelmintic, under the name of *cowhage* or *cow-itch*. The pods, being dipped into treacle or honey, have the hairs scraped off, until the mass has the consistency of an electuary.

MUCUS, *mu'-kus* (Lat.)—A viscid substance, secreted by the various mucous surfaces of the body. All secretions poured upon mucous membranes are more or less mingled with mucus; as the saliva, urine, &c. Its principal office is to protect the mucous surfaces from injury by the contact of foreign substances, and to lubricate the several passages. In certain parts it has special functions; as that of the nose, which is favourable to smell; that of the stomach and intestines, aiding digestion. Its properties are variously altered by disease; becoming acid, mixed with pus, or otherwise changed.

MUDAR BARK. (*See* CALOTROPIS.)

MUD EEL. (*See* LEPIDOSIREN.)

MULATTO, *mu-lat'-to* (Sp., *mulato*, from *mulo*, a mule). (*See* MIXED RACES.)

MULBERRY, *mul'-ber-re.*—A genus of trees (*Morus*) of the natural order *Moraceæ*. The well-known fruit, the Common or Black Mulberry (*M. nigra*), was introduced into Europe from Central Asia at a very remote period. The tree is small in height, with many branches. The heart-shaped serrated leaves are of value as food for silkworms. In the colder part of England and in Scotland it thrives best as a wall tree. The purplish-black fruit, produced in large quantities, has dark-red juice and a fine flavour. In general appearance it resembles a large and very superior kind of blackberry. Preserves and an agreeable wine are made from it. The wood of the tree is sometimes used in cabinet-work. There are trees now existing in this country known to be more than 300 years old, and still bearing. A Chinese species, the White Mulberry (*M. alba*), has been cultivated from very remote antiquity, for the sake of the leaves; but the best variety for feeding silk-worms is the Philippine Mulberry, on account of its rapid growth and the abundance of leaves. The wood of an American variety, the Red Mulberry (*M. aubra*), is fine grained, strong, and altogether superior to that of the black mulberry. There are many other varieties in Cochin China, India, Cashmere, the Mauritius, and Madagascar. In Japan and some other parts of the East, paper is made from the bark of the Paper Mulberry (*Broussonetia papyrifera*), and in some of the South Islands, clothing is made from it, the bark being stripped off and macerated into a pulp, and then pressed and beaten. The fruit of this variety is scarlet, and insipid in taste.

MULE, *mule* (Lat., *mulus*).—An animal which is a hybrid between the female horse and the male ass: the colt of a horse and a female ass, known as a "hinny," being an inferior animal. It has a large, clumsy head, erect ears, a short stiff mane, and a thin tail. It is highly valued in Spain, Portugal, Italy, in the East, and in Spanish America, where its sure-footedness and general adaptability for carrying large burdens, make it of great utility in crossing mountains, &c. Mules are much hardier than the horse, are cheaper to keep, have fewer diseases, and will live and work twice as long. In Spain and America, mules are used as beasts of burden, and are driven in troops. Some mules are very obstinate and even ferocious, and the modern humoristic literature of America abounds with comical mule stories. In the earlier days of the Church, dignified ecclesiastics rode on mules. In the recent Abyssinian and Egyptian campaigns mules were of great service to the transport and commissariat departments; and in some of the large towns of England they have been employed to draw tram-cars.

MULLET, *mul'-let* (Fr., *mulet*).—The common mullet, or grey mullet (*Mugil capito*), is the type of a family of acanthopterygious fishes, termed *Mugilidæ*, to which it necessarily belongs. It is generally about 15 inches in length, but sometimes much larger. The colour of the back and top of the head is a dusky grey, tinged with blue; the sides and under surface of the body silvery white, marked with longitudinal, parallel, dark lines; the membranes of the fins dull white, cheeks silvery white, and the irides reddish-brown. The grey mullet seldom proceeds to any distance from land, as it delights in shallow water, and often proceeds to some distance up the mouths of rivers. It is found in large numbers in Cornwall and Devonshire, and, in fact, along the whole line of our south coast. The mullets prey generally on food in a state of decomposition, and it is one of the few fishes that reject live prey. A variety found in the Mediterranean is of large size, and is the famous mullet for which Roman epicures paid so lavishly. Mullets are considered to be delicious for the table, and are eaten fresh, salted, or smoke-dried. There are several species, differing in slight particulars from the better known fish.

MULTIPLE, *mul'-te-pl* (Lat., *multiplex*).—The multiple of any number is the sum of any number of its *equal* magnitudes. Thus, for example, 20 is a multiple of 5, as four times five = 20, or, that is to say, 5 + 5 + 5 + 5 = 20. As 20 is the multiple of 5, the latter number is inversely termed the *sub-multiple* of 20, meaning that it is contained a certain number of times in the larger one.

MULTIPLICATION, *mul-te-pli-kai'-shun* (Lat., *multiplico*, I multiply).—The operation of finding the *multiple* of a number. The number to be multiplied is termed the *multiplicand;* the number by which that is increased is termed the *multiplier;* and the result of the operation is called the *product*. The rules of multiplication will be found given in the most elementary works on arithmetic. The sign × between two numbers implies that they are to be multiplied together; and in algebra, a similar indication is afforded by the letters symbolizing the quantities being placed side by side, with or without a dot between them, as $a.b$, or ab.

MULTIVALVES, *mul'-ti'-valvs.*—In Conchology, those shelly coverings of molluscs which are formed of more than two distinct pieces.

MUMMY WHEAT.—The name given to a variety of grain, long supposed to have been grown from seeds found in an Egyptain mummy —a supposition now generally regarded as unfounded.

MUMPS, *mumps* (Ang.-Sax.), (Lat., *cynanche paritoidea, parotitis*).—An inflammation of the parotid and submaxillary glands, of a contagious or epidemic origin, almost exclusively confined to young persons. It is generally preceded and accompanied by some degree of fever, and commences with a feeling of pain and tension beneath the ear; then a swelling forms, and the motion of the jaw becomes painful. It usually attains its height in four days, and four days more are occupied by its decline. It ordinarily requires little treatment, beyond the administration of a laxative, and protection from cold, with the application of poultices or other warm substances to the part, or, in severe cases, of leeches. In some cases, after the swelling has subsided, inflammation in glands connected with the sexual system appears and occasionally extends to the brain, and becomes dangerous.

MUNJEET. (*See* RUBIA.)

MUNTJAK, *munt'-jak.*—A species of deer, resembling roebuck, but larger, found in the islands of the Indian Archipelago. The horns of the male are about five inches in length, and from the base springs a small additional horn.

MURÆNA, *mu-re'-na.*—The name of the genus of malacopterous fishes commonly known as eels.

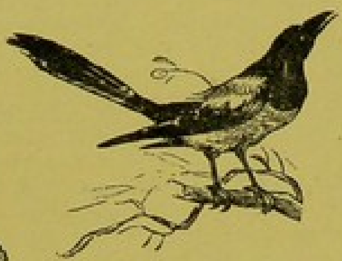
MURCHISONIA, *mur-tchi-son'-i-a.*—A

MARABOU.

MULBERRY.

MARSH MALLOW.

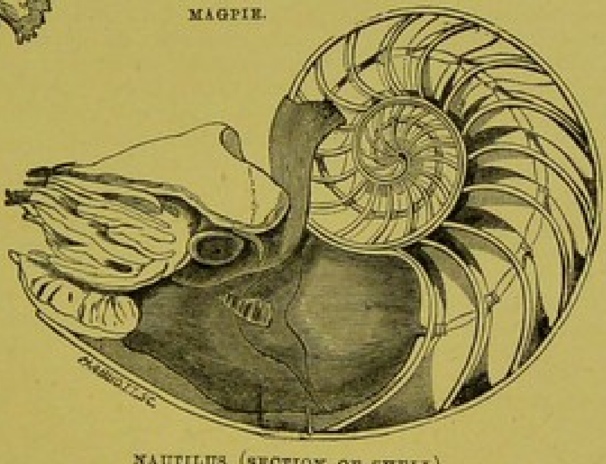
MADDER PLANT.



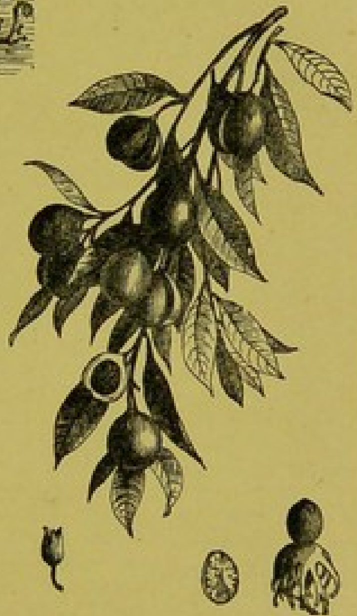
MAGPIE.

NARDOO.

NARCISSUS

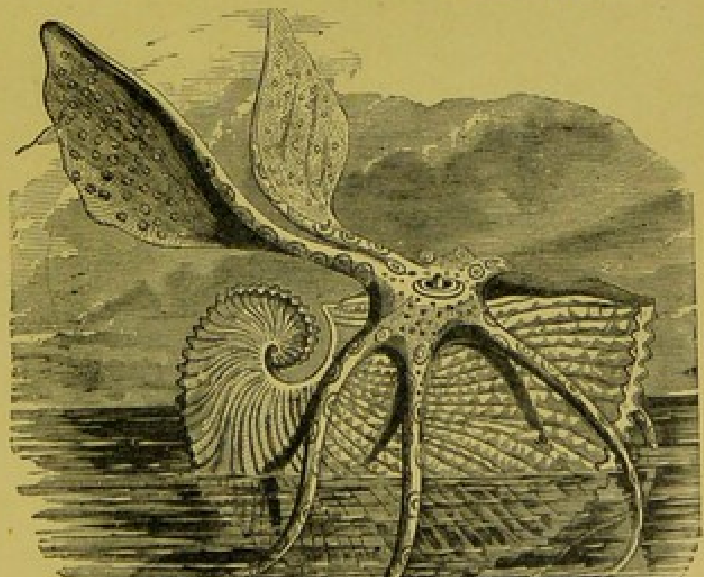


NAUTILUS (SECTION OF SHELL).



NUTMEG-TREE.

NEPENTHES.



NAUTILUS.

group of fossil gasteropodous molluscs, named in honour of Sir Roderick Murchison, the eminent geologist. About 50 species have been discovered in the Palæozoic rocks. They belong to the *Haliotidæ*.

MURICIDÆ, *mu-ris'-id-e*.—A genus of gasteropodous molluscs, some species of which are popularly known as rock-shells, and some as woodcock-shells. Many species have long and regularly-arranged sharp spines on the shells. The largest specimens are tropical, but species are found in all parts of the world. The whorls of the shell are marked with ridges. The famous Tyrian purple dye was obtained from specimens of the Muricidæ. A very beautiful little shell, with long thin spines, found on the Indian seas, is *murex tribulus*, to which the name Venus Comb has been given. Fossil shells of this character are found in some of the more recent geological formations.

MURIDÆ, *mu'-ri-de*.—A family of rodent quadrupeds, which include rats, mice, marmots, lemmings, jerboas, &c.

MURRAIN, *mur'-rin* (Ang.-Nor.)—The popular name for a contagious disease among cattle, generally caused by a hot, dry season, which occasions an inflammation of the blood and a swelling in the throat, which soon become fatal. The symptoms of the disease are a hanging down and swelling of the head, a short and hot breath, profusion of gum in the eyes, rattling in the throat, palpitation of the heart, staggering, and a slimy tongue. The early stage of murrain is one of fever, and the treatment should be regulated accordingly. The disease generally runs its course in eight or ten days. It is of great importance that the infected animal should be immediately removed from the sound ones.

MUSA, *mu'-za*.—In Botany, the typical genus of the natural order *Musaceæ*. *M. paradisiaca* is the plantain, and *M. sapienta* the banana, two important food-producing plants, their fruits being remarkably rich in starch and sugar.

MUSCÆ VOLITANTES, *mu'-se vol-i-tant'-es*.—The term applied by oculists to black spots resembling flies, which, in some conditions of the eyes, appear before them. Sometimes they are indications of a maurosis.

MUSCARDINE, *mus'-car-deen*.—A fungus which grows on silk-worms, and frequently kills them. (*See* BOHYTIS.)

MUSCATEL, *mus'-ka-tel* (Italian, *moscado*, musk).—A name given to many kinds of French and Italian wines, which are strong and sweet in flavour.

MUSCHELKALK, *mos'-shel-kalk* (German, shell lime).—A bed of the New Red Sandstone period, sometimes 300 feet thick, met with mostly in Germany, and unknown in this country. (*See* GEOLOGY.)

MUSCI, *mus'-si* (Lat.)—The Mosses, a natural order of *Acotyledones*, sub-class *Acrogenæ*. Cellular plants with erect or creeping stems, and, usually spirally imbricated leaves. (*See* MOSSES.)

MUSCICAPIDÆ, *mus-si-kap'-i-de*. (*See* FLYCATCHERS.)

MUSCIDÆ, *mus'-si-de*. (*See* FLY.) There are more than 300 species in Britain, among them the house-fly and the blow-fly.

MUSCLE, *mus'-l* (Lat., *musculus*).—In Anatomy, a term applied to the fibrous contractile tissue forming the flesh of men and animals, by means of which the many highly complicated voluntary and involuntary motions of the body are performed. Muscular tissue is of two kinds, distinguished by structural peculiarities and mode of action, the one including the muscles of organic life (with the exception of the fibres of the heart), consisting of simple smooth filaments; the other comprising the muscles of animal life and the heart, and consisting of compounds and apparently striated fibres, or tubes inclosing fibrils. The muscles of organic life, or unstriped muscles, consist of fibres, or, rather, elongated spindle-shaped fibre-cells, which, in their most perfect form, are from $\frac{1}{2700}$ to $\frac{1}{3100}$ of an inch broad, very clear, granular, and brittle, many of them being marked along the middle or one of the edges either by a fine continuous dark streak, or by short isolated dark points. These fibres are collected in divers numbers in fasciculi, and form the proper contractile coats of the digestive canal, urinary bladder, gall-bladder, &c. The muscles of animal life, or striped muscles, are composed of fleshy bundles inclosed in coverings of fibro-cellular tissue, by which each is at once connected with, and isolated from, those adjacent to it. Each bundle is again divided into smaller ones similarly ensheathed, and similarly divisible through an uncertain number of gradations, till, just beyond the reach of the naked eye, one arrives at the primitive fasciculi, or the muscular fibres properly so called. These consist of tubes of delicate structureless membrane, and inclosing a number of filaments. They are of a pale yellow colour, and marked by striæ which pass transversely round them. The primitive fibrils, of which each fasciculus contains several hundreds, are the proper contractile tissue of the muscle, cylindrical, but somewhat flattened in form. The peculiar property of muscular tissue, its contractility, although commonly brought into action by the nervous system, appears to be inherent in the muscular tissue, and not derived by it from the nerves, for it may be manifested in a muscle after being isolated from the influence of the nervous system by division of the nerves supplying it. Muscular contraction is generally believed to be effected by an approximation of the constituent parts of the fibrils, which, without any alteration in their general direction, become closer, flatter, and wider. It is a uniform, simultaneous, and steady shortening of each fibre and its contents. Muscles are usually styled voluntary or involuntary, according as they are, or are not, subject to the influence of the will; but this division is not strictly accurate, and is of little value in a scientific point of view. Many muscles, especially such as are under the immediate dominance of reflex nervous action (as the respiratory and sphincter muscles), partake of both characters; since volition can interfere only temporarily with their contraction; and all muscles, even the most confessedly voluntary, are subject to emotional and instinctive influences, in which the will has no share. Muscles are either elongated and fixed at their two extremities, or hollow and enclosing a cavity. They are so disposed as to give beauty as well as strength to the human body, and for the most part are arranged in pairs; as flexors and extensors, abductors and adductors, supinators and pronators, &c. Muscles are attached to bones by means of tendons, white and shining, rounded or flattened, fibrous cords, and very resisting. The fixed point of a muscle is called its origin, the movable one its insertion. Muscular fibres, especially those of animal life, are constantly in a state of slight contraction, as is evident from the fact that when the action of certain muscles of a part are injured, the antagonistic muscles always draw it towards them. Thus, when the muscles of one lateral half of the face are paralyzed, those of the other half draw the features towards their side. There are in the human body no fewer than 527 distinct muscles, of which 261 are in pairs, and 5 single on the median line. Of these there are 83 in the head and face; 49 in the neck; 78 in the thorax; 33 in the abdomen; 78 in the back, 98 in the upper extremities, and 108 in the lower.

MUSCOVY DUCK, *mus'-ko-ve*.—A bird (*Cairina moschato*) which obtains its name, not, as might be supposed, from the fact of its being a native of Russia, but on account of the strong musky smell with which it is imbued. It is sometimes upwards of two feet in length, and its plumage is usually black, with glosses of green and blue. The muscovy ducks are much more prolific than other species of the family, and their eggs are larger, and tinged with a greenish hue.

MUSHROOM, *mush'-room*.—A genus of fungi, of which there are many species, some poisonous, but others edible and of delicious flavour. (*See* AGARICUS.) The Common Mushroom (*A. Campestris*), a native of most temperate regions, is found in summer and more abundantly in autumn, in pastures and orchards. The shape of the *pilens*, or cap, is regularly convex, fleshy, dry, and with a tinge of yellow or brown. It is cooked as an agreeable accompaniment to chops, steaks, and cold meat; and ketchup is made from it. The Fairy Ring Mushroom (*A. oreades*), somewhat smaller, is also edible. Great care in gathering mushrooms should be exercised. Mushrooms can be grown in boxes, or from cakes of mushroom spawn (sold by gardeners) in dark moist places.

MUSK, *musk*, (Fr., *musc*).—A peculiar, aromatic substance, found in a sac, or small bag, which hangs from the abdomen of a small male quadruped of the deer kind, which inhabits Tonquin and Thibet. In colour, musk is blackish-brown; it is lumpy or granular, somewhat like dried blood, with which substance indeed it is often adulterated. The only criterion of its genuineness is the intensity of its smell. It loses its odour when thoroughly dried, but regains it when moistened with liquid ammonia. The variety most esteemed is that of Tonquin; it comes to this country in small bags, covered with a reddish-brown hair. It is used in medicine, and when taken in a dose of a few grains rouses the energy of the digestive organs, and soon afterwards produces sympathetic phenomena, the powers of the whole animal system appearing suddenly increased. Other effects also prove that it acts on the brain, spinal chord, and ganglionic nerves; such as tendency to sleep, convulsive movements, and particularly spasms of the chest and abdomen.

MUSK-BEETLE, (*Cerambyx moschatus*).—A coleopterous insect, belonging to the family *Cerambycidæ* and the group *Longicornes*. The musk-beetle possesses a peculiar scent—not at all like musk, however, but more like attar of roses. It is found generally on willows in the south of England.

MUSK-CAVY, *ka'-ve*.—A species of *Capromys*, a genus of animals belonging to the class *Mammalia*, order *Rodentia* or *Glires*, and family *Muridæ*. It is about the size of a rabbit or hare, and is exclusively herbivorous. The musk-cavy is so called from the feet of it emitting a strong perfume of musk. It burrows under ground like the mole, and can be thus traced merely by its scent. It is a native of the West-India Islands, in some of which it is called by the natives the *manacou*.

MUSK-DEER.—A tribe of ruminant animals, *Moschus moschatus*, belonging to the family *Bovidæ*, and distinguished from the *Cervidæ* by the absence of horns and the presence of long canine teeth in the upper jaw. A pouch containing a secretion, termed musk, is placed under the abdomen of the males of some of the species. (*See* MUSK.) The animals belonging to this tribe are small and very swift, and elegant in their movements; but little of their habits is known. They are confined to the Old World. The true musk-deer *Moschus*, is about the size and form of a roe-buck, is a shy and timid creature, and inhabits the mountainous regions of Asia, as Thibet and the upper provinces of China.

MUSK-OX.—An animal (*Bos moschatus*) belonging to the family *Bovæa*, but it appears to be the connecting link between oxen and sheep. Its countenance and long hair ally it to the latter class of animals, while its horns and other parts of its form claim for it a connection with the former. It inhabits the barren lands of North America that lie above the 60th degree of latitude. When full grown, the size of the animal is nearly equal to that of the Highland bullock, although rather shorter in the legs. The horns are very broad, covering the brow and whole crown of the head, and touching each other for their whole breadth from before backwards. The head is large and broad. The end of the nose, middle part of the upper lip, and a great part of the lower, are covered with a close coat of short, white hairs. The remainder of the head anterior to the horns is covered with very dark umber-brown hair, long and bushy towards the root of the nose. The eyes are moderately large. The general colour of the hair on the body is brown, on the neck and between the shoulders long, matted, and somewhat curled; on the back and hips it is also long, but lies smoothly. The tail is so short as to be concealed by the fur of the hips. The cow differs from the male in being of a less size, having smaller horns, not touching at the base, and with shorter hair on the chest and throat. It has been termed the *musk-ox* in consequence of its flesh, although liked by some for eating, smelling very strongly of musk.

MUSQUASH, *musk'-wash*.—A genus of rodent Mammalia (*Fiber zibethicus*), known also as the Musk-Rat or Oudatra, belonging to the family *Castoridæ*, termed variously *Musquash*, *Musk-beaver*, or *Musk-rat*. It is a native of North America, and in its appearance and habits resembles considerably the beaver. It is hunted for its skin, which is largely exported.

MUSK-RAT. (*See* MUSQUASH.)

MUSSEL, *mus -sel*.—A well-known mollusc (*mytilus*), which is used by fishermen and others as an article of food. The shells are ovate-triangular, with a marginal cartilage, and sometimes one or two undeveloped teeth under the umbo. The Common Mussel (*M. edulis*) is very abundant both in this country and in the Mediterranean, as well as in the North Sea. They frequent mud-banks. Besides the common mussels, there are also the *Horn Mussels*, distinguished from the former by their habit of digging and burrowing in the sands; besides many other varieties.

MUSTANG, *mus'-tang*. (*See* HORSE.)

MUSTARD, *mus'-tard*.—A genus of plants (*Sinapis*), of the natural order *Cruciferæ*. One row of seeds, brownish-black, is contained in an oblong pod; and these seeds are ground into powder by powerful machinery, and mixed with water to form the familiar condiment for the dinner table. The black mustard (*S. nigra*) and the white mustard (*S. alba*), both natives of the south of Europe, and the the southern parts of Britain, are chiefly used for this purpose. The seed leaf of white mustard, grown in gardens and hot-houses, is an agreeable ingredient in salads. Wild Mustard is known as Charlock. The compound usually known as the oil of mustard is obtained from black mustard by distillation.

MUSTELIDÆ, *mus-tel'-i-de*.—A family of digitigrade Carnivora, including the weasel, ermine, ferret, marten, polecat, &c.

MYLITTA, *mi-lit'-ta*.—A genus of *Fungim. Australis*, called the native bread of Australia, is an edible species, weighing from one to three pounds. It is commonly eaten by the natives. Other species are used in China for food and as medicines.

MYLODON, *mi'-lo-don* (Gr., *mule*, a mill; *odons*, a tooth).—A gigantic fossil quadruped included under the family of extinct *Edentata*, by Owen called the *Megathoridæ*. The mylodon is closely allied to the megatherium, and among existing Edentata it holds a place between the ai and the great armadillo.

MYOPORACEÆ, *mi-o-po-rai'-se-e*. — The *Myopora* family, a natural order of *Dicotyledones*, sub-class *Corolliflorœ*. It is sometimes regarded as a subdivision of the *Verbenaceæ*, from which order it only differs essentially in having pendulous seeds and a superior radicle. The species are chiefly natives of the southern hemisphere. The bark of *Avicennia tomentosa*, the white mangrove, and other species, is much used in Brazil for tanning. The order includes but few useful plants.

MYOSOTIS, *mi-os-o'-tis* (Gr., *mus*, mouse; *otis*, the ear, its leaves being hairy, and growing like the ear of a mouse).—A genus of plants included in the natural order *Boraginaceæ*. The calyx is five-parted, corolla salver-shaped, convolute in the bud; throat closed with scales; limb 5-fid, blunt. Stamen included; filaments very short; style simple. Nuts smooth, convex externally, keeled within, attached by a minute lateral spot near the base. Distinguished from all the other genera by a convolute corolla. Nearly fifty species have been described: eight species are to be met with in Britain. The species are annual or perennial, and are to be found in every quarter of the globe. *M. palustris*, the great water-scorpion grass, or forget-me-not, has the fruit-calyx open, teeth short, triangular, the pubescence of the stem usually spreading. A native of Europe, North America, and Asia, it is generally seen in England in ditches and watery places. It is a beautiful plant, with a large bright blue corolla, having a yellow eye, and, probably on account of its striking appearance, has received its name of forget-me-not. None of the species are used in the arts or in medicine.

MYRIAPODA, *me-re-ap'-o-da* (Gr., *muria*, ten thousand; *podes*, feet), usually designated by the term *Centipedes*, have been classed by Cuvier in the first order of insects. They are the only animals of the order which possess more than six feet in their perfect state, and which have their abdomen not distinct from their trunk. Their body, destitute of wings, is composed of a number of rings, generally equal in size; each of which—a few of the first excepted—bears two pairs of feet, mostly terminated by a single hook; these annuli, or rings, are either entire or divided into two demisegments, each bearing a pair of these organs, and one of these only exhibiting two stigmata. In general, the *Myriapoda* resemble little serpents or nereides, their feet being closely approximated to each other throughout the whole extent of the body. The myriapoda are divided into two families by Cuvier—namely, the *Chilognatha* and the *Chilopoda;* the first of which move very slowly, that is, slide along, and roll themselves into a ball; while the latter possess speedier faculties of locomotion. The Chilognatha are divided by Linnæus into four classes—viz., *Glomeris*, *Iulus*, *Polydesmus*, and *Polyxenus*. The Chilopoda are divided into three classes, comprising *Scutigera*, *Lithobius*, and *Scolipendra*. (*See* also CENTIPEDE.)

MYRICA, *me-ri'-ka*.—The typical genus of the natural order *Myricaceæ*. The species *M. cerifera* is known by the names Waxberry, Candleberry, and Wax Myrtle; its fruits when boiled yield the kind of wax known in commerce as *myrtle wax*. The bark of the root is extensively used in North America as a stimulant astringent in diarrhœa and dysentery. The fruit of *M. sapida* is eaten in Nepaul.

MYRICACEÆ, *me-ri-kai'-se-e*.—The Gale or Bog-myrtle family, a natural order of *Dicotyledones*, sub-class *monochlamydeæ*. The plants of this order are natives of the temperate parts of Europe and North America, of the Cape of Good Hope, and of the tropical regions of South America and India. They are chiefly remarkable for aromatic and astringent properties, and for the waxy substances often contained in their fruits. (*See* MYRICA.)

MYRICARIA, *me-ri-kai'-re-a*.—A genus of the natural order *Tamaricaceæ*. *M. germanica* is a common ornamental shrub in our gardens.

MYRISTICA, *mi-ris'-ti-ka*.—The typical genus of the natural order *Myristicaceæ*. The most important species is *M. moschata* or *officinalis*, the nutmeg-tree. It is a native of the Molucca Islands, but is now cultivated in many tropical regions. The well-known species *nutmegs* and *mace* are derived from this species. The fruit is fleshy and pear-shaped, and commonly about the size of an ordinary peach; it contains a single seed, surrounded by a lacerated envelope, called an *arillode*, which is scarlet when fresh and yellow when dried. Beneath the arillode, which forms the spice called *mace*, we find a hard shell, and within this the nucleus of the seed. This nucleus, or the seed divested of its shell and arillode, is our commercial *nutmeg*. The fleshy pericarp is commonly used as a preserve. Nutmegs and mace are largely employed as condiments. They are both used in medicine as stimulants, carminatives, and flavouring agents. Nutmegs, when distilled with water, yield a volatile oil called *volatile* or *essential oil of nutmegs*. Mace treated in the same way yields a volatile oil of nearly similar properties. The substance called *expressed oil of mace, butter of nutmegs*, or *expressed* or *concrete oil of nutmegs*, imported from the Moluccas, is prepared by heating nutmegs and then submitting them to pressure. It consists of a small quantity of volatile oil mixed with two fatty substances. The nutmegs from *M. moschata* are frequently termed the *true* or *round nutmegs*, to distinguish them from those of an inferior quality obtained from other species. The *long* or *wild nutmegs* of commerce are said to be derived from *M. fatua* or *tomentosa*, and *M. malabarica*.

MYRISTICACEÆ, *mi-ris-te-kai'-se-e.*—The Nutmeg family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*.

MYROBALANS. (*See* TERMINALIA.)

MYROSPERMUM, *mi-ros-per-'mum* (Gr., *muron*, myrrh; *sperma*, seed).—A genus of balsam iferous trees, belonging to the natural order *Leguminosæ*. The species are natives of South America and the West Indies. *M. Toluiferum* is the source of balsam of Tolu, and *M. pereira* that of balsam of Peru. The former product is chiefly imported from Carthagena in gourds and other vessels, usually in the solid state; the latter, which is of a viscid syrupy consistence, is imported from Sonsonate, in the state of St. Salvador Gu atemala. Both are obtained by making incisions in the bark of the trees. They are largely used in medicine for their stimulant and expectorant properties. Two other medicinal products are also derived from *M. pereira*; namely, white balsam, which is obtained from the interior of the fruit and seed by cold pressure; and *balsamito*, or tincture of virgin balsam, which is made by digesting the fruit (deprived of its winged appendages) in rum.

MYRRH, *mir* (Arab., *murr;* Lat., *myrrha*).—A fragrant, bitter, aromatic gum-resin, which occurs in tears of different sizes; they are reddish-brown, semi-transparent, brittle, of a shining fracture, and have a greasy appearance under the pestle. Notwithstanding the early knowledge of myrrh, there was no accurate account of the tree which yielded it until the return of Ehrenberg from his travels, during 1820-25, in various parts of Africa and Asia. The tree, of which he brought a specimen, is described, under the name of *Balsamodendron myrrha*, by Nees Von Esenbeck. This plant was noticed and described by Humboldt in 1826, Myrrh flows from incisions made in the tree. It consists of resin and gum in proportions, stated by Pelletier as 31 of the former and 66 of the latter.

MYRSINACEÆ, *mir-sin-ai'-se-e* (Gr., *mursine*, myrtle).—A natural order of *Dicotyledones*, sub-class *Corolifloræ*, consisting of trees or shrubby plants, with smooth, coriaceous, exstipulate leaves, and small flowers. They are chiefly natives of the islands of the southern hemisphere. The greater number are unimportant in an economic sense. The fruit of *Myrsine Africana* is used by the Abyssinians to mix with the barley given to their mules and asses. The seeds of *Theophrasta Jussiæi* are used in St. Domingo for making a kind of bread.

MYRTACÉÆ, *mir-tai'-se-e* (Gr., *murtos*, the myrtle).—The Myrtle family, a natural order of *Dicotyledones*, sub-class *Calycifloræ*, consisting of about 1,300 species of trees and shrubs. They are natives of the tropics and of the warmer regions of the temperate zones. They are generally remarkable for pungent and aromatic properties, due to the presence of a volatile oil. The fruits of some are edible, as the *pomegranate* and the *guava*. Among the useful products of the order are the well-known spices *cloves* and *allspice*, and the medicinal agents *cajeput oil* and *Botany Bay kino*.

MYRTEÆ, *mir-te'-e.*—A tribe of the natural order *Myrtaceæ*, distinguished by the fruit being baccate. The other tribe, called *Leptospermea*, is characterized by capsular fruit.

MYRTLE. (*See* MYRTUS.)

MYRTLE-WAX. (*See* MYRICA.)

MYRTLE-BIRD.—A bird belonging to the *Syvicolidæ*, a genus of the dentirostral tribe of the order *Passeres*. It has a beak extremely straight and slender, and sharp-pointed, with the upper mandible notched towards the point. As the myrtle-birds are somewhat migratory in their habits, they pass from one part of the country to another, according to the seasons. Their food consists of insects and soft fruits, and they are natives of the United States of America. The plumage of this species is black and yellow, spotted with white, and the bird is between five and six inches long.

MYRTUS, *mir'-tus* (Gr., *murtos*), the typical genus of the natural order *Myrtaceæ*. *M. communis*, the common myrtle, is the most northern species of that order. It was originally a native of Persia, but is now naturalized in the south of Europe. Its dried flower-buds and unripe fruits were used as spices by the ancients, and are still so employed in Tuscany. The agreeable perfume known as *eau d'ange* is prepared by distilling myrtle-flowers with water.

MYSIS, *mi'-sis*, also known as *Opussum shrimps*, a genus of podophthalmous crustaceans, seldom seen on British shores, but abundant in the Arctic seas, where they form part of the food of whales and salmon, &c.

MYSTACEÆ. (*See* SECYTHIDACEÆ.)

N.

NADIR, *na'-dir* (Arab.)—That point in the space around us which is directly opposite to the *zenith*, and consequently under our feet, so that an imaginary straight line would reach from its zenith through the centre of the earth to the nadir. Thus the zenith and nadir are the two poles of the horizon.

NÆVUS, *ne'-vus*, also known as *mother's mark* or *mole*.—A small tumour composed of small dilated blood vessels, or in its simplest form a patch of dilated capillaries. Sometimes these are congenital, hence the name *mother's mark*.

NAG-KASSAR. (*See* MESUA.)

NAIADES, NAIADACEÆ, *nai-ya-dai'-se-e*.—The Pondweed family, a natural order of *monocotyledones*, sub-class *Petaloideæ*, consisting of aquatic plants, with jointed stems and inconspicuous unisexual flowers. They have no known uses.

NAILS are the appendages to the fingers and toes of human beings and the quadrumana, which correspond with the claws and hoofs of other animals. The nails are an altered form of the epidermis, or outward layer of the skin. Under the microscope, a portion of newly-formed nail is found to consist almost entirely of nucleated cells, which are of exactly the same character as those found in the new layers of epidermal tissue. No distinct structure can be observed as the nail grows older, but when immersed in a weak solution of caustic potash or soda the cells become visible. The nails of a human being are produced from a fold in the true skin, which has a highly vascular surface, furnished with longitudinal elevated ridges, to which blood-vessels are copiously distributed, and between which the soft inner layer of the nail drops down. The growth of the nail is caused by additions to its base; but as it moves, it also receives additional matter from the skin, on which it rests. According to M. Beau, the condition of the nails may be made subservient to the diagnosis of disease. When a nail is injured, it is speedily reproduced, except when the skin beneath has been destroyed.

NANDU, OR AMERICAN OSTRICH, *nandew*.—A large bird found in South America. It closely resembles the ostrich, the principal point of difference being that it has the foot three-toed, and also in being more completely feathered on head and neck.

NAPHTHALIN, *nap'-tha-lin* (C_{10} H_8).—One of the innumerable constituents of coal-tar, more especially if obtained from the London gasworks. It forms thin flaky crystals, consisting of rhombic plates, and has an unctuous feel and pearly lustre. It has a peculiar odour and a biting taste. It gradually sublimes at ordinary temperatures, fuses at 175° Fahr., and boils at 424° Fahr. It is insoluble in water, but readily so in alcohol, ether, turpentine, and the fixed oils. Great efforts have been made to obtain colours from it, but hitherto with but little success. The researches of Roussin and others appear, however, to point out a singular relation between naphthalin and alizurin, the colouring matter of madder.

Naphthylamine.—An organic base (C_{10} H_9 N) prepared from Naphthalin. It consists of fine yellowish-white crystalline needles, and some of its compounds are likely to become of great use as colouring matters.

NARCISSUS, *nar-cis'-sus*.—A genus of plants of which the Daffodil and Jonquil (which *see*) are the best known specimens in Britain. They belong to the natural order *Amaryllideæ*.

NARCOTICS, *nar-kot'-iks* (Gr., *narke*, stupor).—Drugs which, in small or moderate doses, produce temporary excitement, which is generally followed by sleep. Most narcotics have a degree of stimulating power, and this is manifested principally when they are given in small doses, while a full dose generally produces the narcotic effect at once, without any apparent stimulation preceding it. Considerable skill and experience are required in the administration of narcotics, both as regards the cases in which they are to be prescribed and the persons to whom they are to be given. They must be distinguished from stimulants on the one hand, and from sedatives on the other; this is the more necessary, because, in nature, the narcotic principle is generally combined with one or the other: hence the unsatisfactory reports of the value of different narcotic remedies, and the difficulty experienced in their application by those who do not know the reason why opium suits one case, hyoscyamus another. A full dose of a narcotic introduced into the stomach will, if the stomach be empty, destroy the desire for food; while, if it contains food, the digestive process is suspended or rendered slower. Their continued or frequent use is therefore injurious to the nutrition of the body, as instanced in the persons of the Oriental opium-eaters. The general action of narcotics is modified by a great variety of circumstances, such as the quantity prescribed, the frequency of repetition, also the force of habit, climate, or season, and, above all, by idiosyncrasy. The amount of action is also largely determined by the age of the person taking the narcotic. To this class of medicines belong opium, hemlock, henbane, belladonna, aconite, stramonium, camphor, digitalis, tobacco, alcohol, ether, nux vomica, leopard's-bane, hop, strong-scented lettuce, and a variety of other substances. Prussic acid has been by some considered as a narcotic, but it does not seem properly referable to this class. It appears rather to be a direct sedative, and never to exert any stimulating power.

Narcotine, *nar-ko-teen'*.—One of the opium alkaloids (formula C_{22} H_{23} NO_7) (which *see*.) It crystallizes in colourless transparent prisms, is insoluble in cold water, only slightly so in hot, and not very freely in alcohol. It is a strong narcotic, though not so strong as morphia.

NARD AND NARDOSTACHYS, *nar-dos'-tak-is* (Gr.)—A genus of the natural order *Valerianaceæ*. The species *N. Jatamanzi* is the true *spikenard* of the ancients, called *nard* by the Hebrews, and *nardos* by the Greeks. It is much esteemed by the Hindoos as a perfume, and also as a remedial agent in epilepsy and hysteria. Its root is supposed to constitute the *sumbul*, or musk-root, which is imported into this country from Bombay and Russia. This root has powerful stimulant and antispasmodic properties, and is employed medicinally.

NARDOO, *nar'-do* (*Marsilea quadrifida*).—A plant found in Australia, the spore-cases of which, when pounded like flower, are made into cakes. It belongs to the acotyledonous natural order *marsileaceæ*.

NARDUS, *nar'-dus*.—A genus of grasses consisting of a simple spike, and having little spikes on one side. *Nardus stricta* is very common in Britain, and is popularly known as MAT GRASS.

NARWHAL. (*See* WHALE.)

NASALIS, OR PROBOSCIS MONKEY, *nas-a'-lis*.—A monkey (*Nasalis larvatus*) found in Borneo and neighbouring islands, and distinguished from all its congeners by having a very long nose, this feature being usually four inches long. It has also a very long tail. It can leap to a great distance—fifteen feet, or even more. In habits it is gregarious.

NASCENT CONDITION, *nas'-ent* (Lat., *nascor*, I am born).—A term applied to the element or compound when in the act of being eliminated from other bodies. In this state it often manifests more energetic affinities than when obtained in an isolated form. For instance, chlorine and cyanogen do not enter directly into combination; but if cynanide of mercury be decomposed by chlorine, the nascent cyanogen will immediately combine with it to form chloride of cyanogen.

NASTURTIUM, *nas-tur'-she-um* (Lat.)—A genus of the natural order *Cruciferæ*. *N. officinale* is the common water-cress, one of the most wholesome of our popular salad vegetables. It has remarkable antiscorbutic properties, and is interesting in a chemical point of view from containing iodine. The name *Nasturtium* is commonly given to *Tropæolum Majus*, the Indian cress, a showy and useful garden-plant. (*See* TROPÆOLUM.)

NATATORES, *na-ta-to'-reez* (from *nato*, I swim).—A name applied in Natural History to such birds as are web-footed, and otherwise adapted to lead an aquatic life. The order includes no less than five different families, which may be here mentioned—namely, the *Anatidæ*, or ducks; the *Colymbidæ*, or divers; the *Alcidæ*, or auks; the *Laridæ*, or gulls; and the *Pelicanidæ*, or pelicans; all of which wlll be found fully described under their different headings. Birds of this class vary greatly both in the size of their wings and powers of flight, and they are all easily distinguishable from the rest of the feathered tribes, on account of the peculiar structure of their feet, which are invariably webbed. A thick coat of down also covers the bodies of *natatores* beneath their plumage, and an oily secretion covers the feathers, and saves them from getting wet.

NATIVE.—A term which, when applied to minerals, means that they are discovered nearly pure; thus, native silver means silver found pure, or nearly so; while, as a rule, silver is found alloyed with other metals.

NATRON, *nai'-tron*, or Trona (from Natron, a lake of Judea, where it was found), native sesquicarbonate of soda, combined with a proportion of chloride of sodium and sulphate of soda. It is chiefly obtained as an efflorescence on the borders of certain lakes, those of Egypt being the best known. It is also found near the Black and Caspian Seas, in Thibet, and Siberia.

NATURAL HISTORY.—In its extended signification, that science which investigates the descriptions and pecularities of all bodies belonging to nature that we can see; but the term is generally restricted to the external description of objects of nature, whether vegetable, animal, or mineral. It is consequently divided into three separate headings:—1. *Geology and Mineralogy*; 2. *Botany*; and 3. *Zoology*. Natural history is indebted to Aristotle for its first organization; and since the days of that philosopher, many and vast improvements have been made in the various branches of the science. Lord Bacon was one of those who did much for natural history, and following in his steps came Gesner, Aldrovandi, Ray, Tournefort, and, greatest of all, Linnæus. Buffon and Cuvier also improved the science, and Professor Owen, Mr. Huxley, Mr. Darwin, and other eminent scientists of the present day likewise enlarged the theories on the subject. (*See* also BOTANY, GEOLOGY, ZOOLOGY, &c., &c.)

NATURAL PHILOSOPHY. (*See* PHYSICS.)

NATURALIZED, *nat'-u-ral-ized*.—A term applied to those plants and animals which have been introduced by man from their native land into a different country, and have so established themselves there that they can live without care.

NAUSEA, *naw'-shea*.—A sensation of sickness and desire to vomit, unaccompanied by pain, but most distressing in itself. It is the common symptom of dyspepsia and disorders of the stomach, but it may also occur as an indirect symptom of disturbance in the brain or kidneys; it may also be produced by nervous and emotional diseases. When it occurs to women in the morning, during the child-bearing period, it is one of the surest signs of pregnancy. In this case, it is caused by the irritation in the stomach excited by the enlarged uterus.

NAUTILUS, *naw'-te-lus* (Gr., *nautilos*, from *naus*, a ship).—A class of molluscs, belonging to the family *Cephalopoda*, and termed *Argonauta* by Linnæus, remarkable for the shape of its shell and the peculiar method it has of sailing over the sea by means of employing six of its tentacles as oars, and using the other two membraneous ones for sails. If the sea becomes rough, or it perceives any danger, the nautilus withdraws all its arms, concentrates itself into its shell, and sinks to the bottom. The body of the animal does not adhere to the spirals with which its shell is plentifully convolved, and some authors have affirmed that it is a parasite; but as it is always found in the same shell, and as no other animal has been ever found therein, this assertion is highly problematical. The most common species is the *Nautilus pompilius*, which is a native of the Indian seas, especially about the Molucca Islands. (*See* also MOLLUSCA.)

NAVEW, *na'-vew*.—A garden vegetable something like the turnip in method of growth; taste, stronger in flavour; shape, something like the carrot. It is much cultivated in France.

NAVICULA, *na-vi'-ku-la*.—A genus of *Diatomaceæ*, resembling in form a little boat. (*See* DIATOMACEÆ.)

NAVICULAR DISEASE, a strain of

the flexor tendon of a horse's foot where it passes over the navicular bone.

NEAP TIDES. (*See* TIDES.)

NEBULÆ, *neb'-u-le* (Lat., *nebula*, a cloud). A name given to certain diffuse cloudy patches of light which have been discovered in all parts of the heavens. These objects appear to be attributable to two totally distinct causes: first, those which, by the aid of powerful telescopes, we can resolve into clusters of distinct stars; and second, those which are found to consist of a diffusive substance pervading space. The application of the telescope to astronomical science revealed the nature of the first class of nebulæ—namely, clusters of stars; such, for example, as the group of the Pleiades, that of the Hyades, in the constellation Taurus, and that which surrounds θ Argus, &c. All these clusters have very precise and well-defined forms, and are constituted of stars which are very near each other. For the first examination and analysis of these remarkable objects, astronomy is indebted to Sir W. Herschel, who divided them into the following classes: 1, clusters of stars in which the stars are clearly distinguishable; 2, resolvable nebulæ, or such as excite a suspicion that they consist of stars, and which any increase of the power of the telescope might be expected to resolve into distinct stars; 3, nebulæ, properly so called, in which there is no appearance of separate stars; 4, planetary nebulæ; 5, stellar nebulæ; and 6, nebulous stars. For several years Herschel maintained that all nebulæ were clusters of stars; but a series of minute and very delicate observations of the most conscientious character induced him to modify his views on the subject, and conclude that there are nebulosities which are not of a starry nature. From that time it was understood among astronomers that the star, the planets, the satellites, and the comets, were not the only celestial objects to which attention was to be directed. There were also the true nebulæ, the diffuse celestial matter, which opened up a new field of philosophical research. The first nebulæ mentioned in the annals of astronomy is the nebulæ in the girdle of Andromeda: it was discovered in 1612, by Simon Marius. That astronomer compared the light of the nebulæ to that of a candle seen through a piece of horn. In 1656, Huygens described, in his "Systema Saturnium," the great nebulæ in the constellation of Orion, situated near the sword-scabbard around the star marked θ. It would appear, however, that this same nebulæ was known to Cysatus, the Swiss astronomer, as early as the year 1618. In 1716, Halley having undertaken to enumerate the known nebulæ, found that their number amounted only to six—the two before cited and four others. In 1755, however, Lacaille, during his residence at the Cape of Good Hope, determined the positions of fourteen nebulæ, in the structure of which his weak telescopes showed nothing definite, and fourteen other nebulæ, which the same telescopes resolved into stars. In 1786, Sir William Herschel published a catalogue of 1,000 nebulæ or clusters of stars, and three years afterwards, to the astonishment of observers, produced a second catalogue quite as extensive as the first, and in 1802 a third catalogue of 500 nebulæ in addition. Those nebulæ which can be resolved into separate stars exhibit a great variety of forms. There are some which, at once very elongated and very narrow, might be even taken for simple luminous lines of a straight or serpentine form. There are others, again, which open in the form of a fan, resembling the jet of light which escapes from a strongly-electrified point. In some the centres are not distinguished by any regularity; in others one might expect to see the head of a comet, with its nucleus. The forms of very large diffuse nebulæ, properly so called, do not appear to admit of definition. They have no regular outline; they display all the fantastic figures which characterize clouds carried away and tossed about by violent and often contrary winds. The light of these large milky patches is generally very faint and uniform; but here and there are to be remarked some spaces brighter than the other parts. It is argued by some astronomers that the phosphorescent matters constituting the diffuse nebulæ is gradually condensed into stars. This bold idea is not so novel as it has been generally imagined to be. As early as 1572, Tycho Brahé regarded the new star of that year as the recent agglomeration of the diffuse matter distributed in space, which he called the celestial matter. The term of *planetary nebulæ* was applied by Sir W. Herschel to those nebulæ which resembled in form the planets of our own system. He also applied the term *nebulous stars* to those stars which were surrounded by a nebulosity depending upon themselves, and constituting an integral part of them; such as the star of the eighth magnitude situated in the left foot of Perseus. Amongst the most singular nebular phenomena are the Magellanic clouds, situated in the southern hemisphere. The larger of these covers 42 square degrees, and the smaller 10 square degrees of the celestial vault. In a fine moonlight night the smaller cloud becomes entirely effaced, and the other loses a large part of its brightness. The latest contributions to nebular astronomy are due to Lord Rosse. One of the most remarkable facts disclosed by his observations consists in the spiral arrangement of several of the nebulæ. It would also appear from them, that several nebulæ, which have been considered irresolvable, consist of clusters of stars. This would seem to suggest that all objects of this class are in reality agglomerations of stars, but the subject is one on which there is considerable diversity of opinion.

NECK, *nek* (Sax., *necca*).—That part of the body which connects the head with the trunk. It is principally made up of the cervical vertebræ, and the numerous muscles which cover them, and are concerned in their different movements, and in those of the head and shoulders. The pharynx and œsophagus lie in contact with the front of the vertebral column, and the larnyx and trachea in front of these. The large blood-vessels of the head pass through the neck on the front of the spine, and some important nerves take nearly the same course. These several organs, connected together rather loosely by cellular substance and surrounded by integuments, compose the neck.

NECROPHILISM, *ne-krof'-il-ism.*—A morbid and unnatural love or appetite for the dead, which has led persons to inhabit grave-yards and even to exhume corpses.

NECROSIS, *ne-kro'-sis* (Gr., *nekros*).—The death or mortification of a part or the whole of a bone, but the term is often restricted to cases in which the shaft of a long bone dies from injury or inflammation, and is enclosed in a case of new bone. Necrosis differs from caries of a bone, inasmuch as in the latter case the vitality of the bone is only impaired, not destroyed, as in the former: in the same way as ulceration of the soft parts differs from gangrene. Necrosis is found in either sex, and at all periods of life, and may be occasioned either by external causes, as fractures, contusions, &c., or by internal or constitutional causes, as a debilitated or deranged habit of body. When a portion of a bone becomes dead, it is regarded as an extraneous substance, and its removal from the part, either by the action of absorbents or by a surgical operation, is absolutely necessary. Its detachment and removal become as necessary for the process of reparation and the cure of the patient as the taking away of any other extraneous substance lodged in any part of the human frame, and keeping up irritation, suppuration, and other effects.

NECTANDRA, *nek-tan'-dra.*—A genus of the natural order *Lauraceæ.* The species *N. Rodeie* is the Bibiru or Bebeera Tree, a plant of considerable importance. It yields the wood called greenheart, which is largely imported into this country from Guiana and the West Indian Islands, for ship-building and other purposes. This timber is heavy, hard, and durable, but rather apt to split; it takes a good polish, and is remarkable for its olive-green colour. The bark of this tree has been used of late years as a substitute for the cinchona barks in medicine. Its tonic, antiperiodic, and febrifuge properties are due to the presence of a peculiar alkaloid, called bibirine, or bebeerine, which may be employed by itself, or in the form of a sulphate, as a substitute for quinine. The seeds of the bibiru contain starch, which is mixed with a species of decayed astringent wood and a certain quantity of cassava starch, and made into a kind of bread by the South American Indians. *N. cymbarum* yields the substance called Brazilian sassafras. The cotyledons of *N. Puchury, major* and *minor*, are imported from Brazil, under the names of sassafras-nuts and pichurium beans. They are used for flavouring chocolate.

NECTARINE, *neck-tar'-in.*—A fruit tree of the same genus as the almond. (*See* AMYGDALEÆ.) It closely resembles the peach, only it has a smooth instead of a downy skin. (*See* also PEACH.)

NECTARY, *neck-ta'-ry.*—An organ in many plants, used either in the secretion or the reception of honey.

NEEM TREE. (*See* MELIACEÆ.)

NEGATIVE QUANTITIES. — Those quantities in Algebra which are opposite to *positive quantities*, and which are characterized by having the symbol $-$ prefixed to them. The theory of negative quantities is attended with great difficulty and many obstructions when it ascends to the higher branches of mathematics. In the expression $a-b$, where a is greater than b, the quantity can readily be solved; but when we have $a-b$, where b is greater than a, the expression is attended with much difficulty, as is also $-a$ by itself. The best definition, and what is most natural, is that given by Newton, and followed by Euler, that negative quantities are less than nothing; the second definition is usually adopted with regard to mechanics, that negative quantities are similar to positive quantities, only that they are taken in a contrary sense or opposite direction. D'Alembert, however, has shown that both these definitions lead to inaccurate notions. He observes: Let there be the proportion $1 : -1 :: -1 : 1$, which is true in its results, because the product of the means must equal the product of the extremes, or *vice versâ.* Now, it must be considered that if -1 be less than nothing, it will be consequently much more less than the positive number 1; therefore it can be deduced that the second term is less than the first, and consequently the fourth be less than the third—that is to say, 1 will be less than -1; but it has been proved to be greater than -1, consequently it will be both less and greater, which is absurd. The only true interpretation which we can attach to a *negative quantity* is that it is an absolute quantity which does not conform to the system of reasoning by which positive quantities are governed, but that it relates to another system in such a manner that, in order to render the formulæ for the first system applicable to it, the sign which precedes it must be changed from $+$ to $-$, or from $-$ to $+$. For instance, if y represents the difference between a and z, it does not follow that by substituting $-y$ for $+y$, the quantity represented by y becomes negative, but merely that of the two quantities a and z, the one which was the greater in the case in which y has the sign $+$, becomes the smaller when the symbol of y is changed into $-$. (*See* IMAGINARY QUANTITIES.)

NEGATIVE SIGN.—The algebraic sign, consisting of a dash, thus $-$, also called *minus.*

NEGRO, *ne'-gro* (Lat., *niger*, black), is a name properly applied to a race or variety of the human species, inhabiting the central portion of Africa, principally between lat. 10° N. and 20° S., on account of one of their most striking characteristics—their black colour. They do not include the Egyptians, Nubians, Abyssinians, &c., of Northern, nor the Hottentots of Southern Africa. Their characteristics are, skin black, hair woolly, lips thick, nose depressed, jaw protruded, forehead retiring, proportions of the extremities abnormal. They occupy about one-half of Africa, and out of Africa are found in the United States, the West Indies, Brazil, Peru, the Cape Verd islands, and Arabia, most of them or their parents having been brought to these places in the condition of slavery. The Egyptians became acquainted with negroes through the conquests of their rulers about 2300 B.C., and represented them on their monuments as early as 1600 B.C.; whence we know that for nearly thirty-five centuries the type has remained unchanged. They were unknown to the Greeks till the 7th century B.C. In Africa the negro tribes have in general elevated themselves considerably above the simple state of nature, living in settled habitations, practising a rude agriculture, and carrying on certain manufactures. They display considerable ingenuity in the manufacture of weapons, the working of iron, weaving of mats, cloth, and baskets from dried grasses; in the dressing of skins of animals, structure of their huts and household utensils, and the making of various implements. Their religion is a species of fetichism, and they believe in good and evil spirits, witchcraft, charms, and spells, omens, lucky and unlucky days, &c. Though cruel to their enemies and prisoners, and setting little value on human life, they are naturally kind-hearted, affectionate, hospitable to strangers, unsuspecting, and communicative of their joys and sorrows. They are of a cheerful disposition, and passionately fond of music. Their languages are described as extremely rude and imperfect, almost destitute of construction, and incapable of expressing abstractions.

Negritos, *neg-ri'-too.*—A name given by the Spaniards to certain tribes resembling Negroes, who inhabit the interior of the Philippine Islands.

NELUMBIACÆ, *ne-lum-be-ai'-se-e.*—The Waterbean order of *Dicotyledones*, sub-class *Thalamifloræ*. The beautiful plants of this order are natives of stagnant or quiet waters of temperate and tropical regions in the northern hemisphere, being most abundant in India. There is but one genus, namely, *Nelumbium*, which includes three species. The most interesting plant is *N. speciosum*, the fruit of which is commonly considered to have been the Egyptian bean of Pythagoras, and the flower the lotus often represented on the monuments of India. (*See* LOTUS.) The leaf and flower-stalks contain a large number of spiral vessels. These are extracted and burnt as wicks in the sacred lamps of the Hindoos on great and solemn occasions. The Chinese and Egyptians cultivate the plant for the sake of the seeds, roots, and stalks, all of which are eaten. The seeds are about the size of acorns, and have a delicate flavour. The root yields a great amount of starch, from which the Chinese arrowroot is supposed to be obtained. In China the root is served at table in slices, pickled, and it is also used as an ingredient of soup. The seeds and roots of an American species, *N. Luteum*, are also eaten.

NELUMBIUM. (*See* previous article.)

NEMATELMIA, *nem-a-tel'-mi-a* (Greek, *nema*, a thread, *helmins*, an intestinal worm).—A class of the subdivision *Vermes* of the *Articulata*, including many of the parasites found in the human intestines. They are sometimes known as round-worms to distinguish them from the *Platyelmia* or flat worm. The most highly developed of these worms, having a perfect intestinal canal, are the *Nematoides*. Other worms of the kind are the *Acanthocephata*, and the *Gordiacea*.

NEMERTIDÆ, *nem-er'-ti-de.*—A family of marine *Annelida* possessing the remarkable power of stretching from their ordinary length, three or four feet, to thirty or forty. The structure somewhat resembles that of a leech, and they twine themselves when caught in a net, into apparently inexplicable knots and coils. They live chiefly upon molluscs, which they suck out of their shells.

NEMOCERA, *ne-mos'-e-ra* (Gr., *nema*, a thread, and *keras*, horn).—A class of dipterous insects, including those which have long filiform antennæ. In this family, the antennæ usually consist of from fourteen to sixteen points. They are frequently hairy, particularly in the males, and much longer than the head. The body is elongated, the head small and rounded, the eyes large, the proboscis salient, and either short and terminated by two large lips, or prolonged into a siphon-like tube, with two exterior palpi inserted at its base, and composed of four or five joints. The abdomen is elongated, and most commonly formed of nine annuli; it terminates in a point in the female, but is thicker at the end, and furnished with hooks in the males. The legs are very long and slender, and are frequently used as instruments by which the insects can balance themselves. They are found at nearly every season of the year, and usually flit together in the air in numbers. The larvæ are always elongated, and resemble worms. (*See* MOSQUITO.)

NEPENTHACÆ, *ne-pen-thai'-se-e* (from Gr., *ne*, not; *penthos*, grief).—The Pitcher-plant family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*. The plants are herbaceous or somewhat shrubby. Leaves alternate, and terminated by a pitcher-shaped structure, provided with an articulated lid. There is but one genus, *Nepenthes distillatoria*, which includes about 14 species, natives of swampy ground in China and India.

NEPHELIUM, *ne-fe'-le-um.*—A genus of the natural order *Sapindaceæ*, of China and the Indian Archipelago. The fruit is delicious. (*See* LITCHI.)

NEPHRITE, *nef'-ri-te.*—A mineral composed of silica, magnesia, and lime, frequently named Jade. (*See* JADE.)

NEPHRITIS. (*See* KIDNEYS, DISEASES OF THE.)

NEPTUNE, *nep'-tune.*—A name given to the most remote of the members of our planetary system. The discovery of this planet, by means of an investigation concerning certain perturbations which were observed in the movement of the neighbouring planet Uranus, must always stand forth as one of the most brilliant scientific feats on record. About forty years after the discovery of the planet Uranus by Sir W. Herschel, new tables of that planet were published by Bouvard, the French astronomer. In the Introduction to these tables, an unexpected result was announced. On comparing the earlier observations of the planet with those of 1781, it was found that both sets of observations could not be included in the same orbit. Bouvard seems to have suspected that this discordance was due to the disturbing influence of some unknown planet. This belief began to be strengthened when it was found, in 1821, that the planet began to exhibit a deviation from Bouvard's tables of 1781. This deviation continued to increase till 1830, when the error in longitude amounted to as much as half a minute of space. In 1843 the subject was closely investigated by Mr. J. C. Adams, of St. John's College, Cambridge; and in October, 1845, he communicated to the Royal Observatory the elements of a hitherto unknown planet, which he asserted must be in existence. Singularly enough, at the same time M. Leverrier, in France, was pursuing investigations in the same direction, and had also pointed out that a planet of similar density would be found in the same direction. On the 23rd of September, 1846, M. Leverrier wrote to Dr. Galle, one of the astronomers at the Royal Observatory at Berlin, announcing to him the result he had arrived at, and requesting him to look for the disturbing planet in or near the place assigned by his calculation. He did so, and on that very night actually found it. Neptune is not visible to the naked eye. Its sidereal revolution is completed in 164 years and 266 days, and its greatest distance from the sun is 2,895 millions of miles.

NEREIDÆ, *ne-re-i'-te.*—A family of marine *Annelidæ*. They have a distinct head, with a thick strong proboscis, and two jaws, tentacles and eyes, and a long slender body, which is covered with tubercles. They generally hide in the earth or under rocks, but swim rapidly by means of numerous bristles and flaps on the sides.

NEREITES, *ne'-re-ites.*—In geology, animals which apparently somewhat resembled the preceding, and have left their impress on the Silurian rocks.

NERIUM, *ne'-ri-um.* (*See* OLEANDER.)

NERVES. (*See* NERVOUS SYSTEM.)

NERVOUS SYSTEM, in Anatomy and Physiology, that portion of the organism of man by which the mind is brought into connection with the physical world. The nervous system consists of two portions or constituent systems—the cerebro-spinal and the sympathetic or ganglionic. The *cerebro-spinal* system includes the brain and spinal cord, with the nerves proceeding from them. It includes those nervous organs in and through which are performed the several functions with which the mind is more immediately connected, as those relating to sensation and volition. The *sympathetic* or *ganglionic* system, named by Bichat the nervous system of organic life, consists of a chain of ganglia extending from the cranium to the pelvis along each side of the vertebral column, and from which nerves with ganglia proceed to the viscera in the thoracic, abdominal, and pelvic cavities. This system appears to regulate, independently of the will, important functions of the bodily organs, as respiration, circulation, and digestion. (*See* GANGLION.) The several organs of the nervous system are composed of two different substances, which differ from each other in density, colour, minute structure, and chemical composition. They are the vesicular-nervous and the fibrous-nervous matter, the former being also called the grey or cineritious substance, the latter the white or medullary. The former is distinguished by its dark reddish-grey colour and soft consistence, and is found usually collected in masses and mingled with fibrous structure, as in the brain, spinal cord, and the several ganglia, but never in the nerves. The masses constitute what are termed nervous centres, being the organs in which it is supposed that nervous force may be generated, and in which are accomplished all the various reflections and other modes of disposing of impressions when they are not simply conducted along nerve-fibres. The fibrous nerve-substance, besides entering into the composition of the nervous centres, forms alone the nerves or cords of communication which connect the various nervous centres with the different tissues and organs. The vesicular nervous substance is composed, as its name implies, of vesicle or corpuscles, commonly called nerve or ganglion corpuscles, containing nuclei and nucleoli; the vesicles being imbedded either in a finely granular substance, as in the brain, or in a capsule of nucleated cells, as in the ganglia. Each vesicle consists of an exceedingly delicate membraneous wall inclosing a finely granular material, part of which is occasionally of a coarser kind and of a reddish or yellowish-brown colour. The nucleus is vesicular, much smaller than the vesicle, and adherent to some part of its anterior. The nucleolus, which is inclosed within the nucleus, is vesicular in form, of minute size, and peculiarly clear and brilliant. The nerve-corpuscles vary in shape and size; some are small, spherical, or ovoidal, with an uninterrupted outline. The fibrous-nervous matter consists of two different kinds of nerve-fibres, which are distinguished as the tubular fibre and the gelatinous fibre. In most nerves these two kinds are intermingled, the tubular fibres being more numerous in the nerves of the cerebro-spinal system, the gelatinous predominating in the nerves of the sympathetic system. The nerve-fibres vary in size, being largest within the trunk and branches of the nerves, and becoming gradually smaller as they approach the brain and spinal cord, and usually, also, in the tissues in which they are distributed. The tubular fibres, in a perfectly fresh state, present the appearance of simple membraneous tubes, perfectly cylindrical, and containing the proper nerve-substance, a transparent oil-like and apparently homogeneous material, but which, shortly after death, undergoes a change, and has the appearance of being composed of two different materials; the internal or central part, occupying the axis of the tube, becomes grayish, while the outer or cortical portion becomes opaque, and dimly granular or grumous, as if from a kind of coagulation. The gelatinous fibres constitute the main part of the trunk and branches of the sympathetic nerve, and are intermingled in various proportions in the cerebro-spinal nerves. They are flattened, soft, and homogeneous in appearance, and when collected together in great numbers, they present a yellowish-gray colour. They differ from the tubular fibres in being only one-half or one-third of their size, in the absence of the double contour, their apparently uniform structure, and their yellowish-gray colour. Nerves, in their course, subdivide into branches, and these frequently communicate with the branches of a neighbouring nerve; but in these communications the nerve-fibres never coalesce, but merely pass into the sheath of the adjacent nerve, become intermixed with the nerve-fibres, and again pass on to become blended with the nerve-fibres in some adjoining fasciculus. Every nerve-fibre in its course proceeds uninterruptedly from its origin at a nervous centre to its destination; and however long its course, there is no branching or anastomosis, or union with the substance of any other fibres. The communications which take place between two or more nerves form what is called a *plexus*, in which the component nerves divide, then join, and again subdivide in such a complex manner that the individual fasciculi become most intricately interlaced. As the small bundles of nerve-fibres approach their final and minutest distributions in the several tissues, they commonly form delicate "terminal plexuses." The primitive fibres appear to terminate in various ways, as in loops, in plexuses, by branching, by free ends. The central termination of a nerve-fibre is that in connection with a nerve-centre; the peripheral termination, that in connection with the different organs and tissues. The sympathetic nerve consists of tubular and gelatinous fibres intermixed with a varying proportion of filamentous areolar tissue, and enclosed in a sheath of fibro-areolar tissue. The tubular fibres are for the most part smaller than those composing the cerebro-spinal nerves, and their double contour is less distinct. Nerve-fibres appear to possess no power of generating force in themselves, or of originating impulses to action; but they possess a certain property of conducting impressions, but which is never manifested till some stimulus is applied. This property of nerves is called excitability, irritability, or nervous force and one of its peculiarities is the rapidity with which it travels along the nerve-fibres. All stimuli, internal or external, chemical, mechanical, or electrical, when applied to sensitive nerves, produce sensations, and when applied to motor nerves, excite contractions. There are certain kinds of nerves, however, the irritation of which produces effects that are entirely peculiar to themselves: thus, irritation of the optic nerves causes the sensation of light; of the auditory nerve, of sound; and of the olfactory or gustatory nerves, of smell and taste.

Nervous Diseases.—Nervous diseases are properly divided into structural and functional diseases of the nervous system; the former arising from some morbid change or lesion in the nerve structures, the latter including those in which there is no morbid change or lesion to account for the symptoms. Structural diseases may be divided into—1. Those of the brain and spinal cord, and their coverings or membranes; and 2. Diseases of the nerves. The brain and spinal cord are subject to diseases affecting their membranes, their substance, and their blood-vessels. (*See* BRAIN, DISEASES OF THE.) Diseases of the nerves themselves are not numerous. They may arise from inflammation of the delicate fibrous sheath which envelops the nerves, from the development of tumours near the origin or along the course, or amid the ramifications of the nerves; or from the bulbous expansion of the extremities of divided nerves, occurring after amputation, and causing painful stumps. The functional diseases of the nervous system manifest themselves by irregular, depressed, or exalted conditions of the processes and peculiar functions of the system—viz., sense, sensation, and motion. They may be enumerated as follows:—1. The numerous varieties of neuralgia, which are independent of disease of the nerves or their centres (*see* NEURALGIA). 2. The various forms of insanity and general paralysis where no morbid change occurs in the brain to account for the symptoms. 3. The various exhibitions of mental and moral perversity, constituting the diseases known as hysteria, convulsions, paralysis of sensation and motion, &c. 4. Delirium tremens, that derangement of the nervous functions manifested by optical illusions, hallucinations, mania, and muscular trembling, which arises from exhaustion of the nervous power produced by prolonged stimulation by alcohol. 5. Chorea, or St. Vitus's dance, an affection occurring generally in young girls, and consisting in irregular contractions of the voluntary muscles, and which has been graphically described as "insanity of the muscles." 6. The convulsions and paralysis that occur in infancy and childhood, from the irritation of teething, or from gastric and intestinal derangements. 7. Tetanus, or locked-jaw, a rigid spasm of the voluntary muscles, arising from an exalted state of the reflex function of the spinal cord, sometimes spontaneous, but more frequently the result of lacerated wounds. Hydrophobia may be included under this head. 8. The rare and curious derangement known as catalepsy and ecstasy. Epilepsy is sometimes a purely functional, sometimes an organic disease. These several diseases will be found described under their special heads in other parts of this work.

NEST. (*See* BIRDS.)

NEST-BUILDING APES.—An African ape (*Troglodytes calvus*), named by the natives of the tropical coast-region of Western Africa, the Nstriego Mbouve, was first described by M. Du Chaillu. It forms an umbrella-shaped covering on a branch about 15 or 20 feet from the ground, and there it sleeps in security from attack. Another African ape, known as the Nshriego Nkengo, also makes a nest by bending over and intertwining the thin branches of trees.

NESTS (Sax., *nestan*).—Small structures, generally constructed with great ingenuity, by birds and various small animals for the rearing of their young. For birds' nests, *see* BIRDS. Among mammalia, the only nest-builders are some of the rodents, as mice and squirrels, and some of the nests made by these animals are as ingeniously constructed as those of birds. No reptiles are known to construct nests; but it has been recently discovered that a few fishes make them; and the nests of sticklebacks are now commonly to be seen in the fresh-water aquariums. Bees, wasps, ants, and some species of spider, especially the water-spider, construct nests.

Nests, Edible. (*See* BIRDS' NESTS, EDIBLE.)

NETTLE, *net'-tl.*—A genus of plants (*Ustica*), of the natural order *Usticeæ* (which *see*). They are herbaceous shrubs, and in some species trees. Many are covered with hairs, which, when touched, pierce the skin, and emit an acid juice, causing much inflammation and pain. A vigorous grasp will press the hairs and the stem, and no pain will be felt, a fact which gave rise to the well-known old lines,—

"Tender-handed touch a nettle, and it stings you for your pains,
Grasp it like a man of mettle, and it soft as silk remains."

The most acrid are some of the East Indian species, particularly *U. crenulata*, the inflammation caused by it sometimes lasting for more than a week. In this country, the Great Nettle (*U. dioica*), is very abundant. In some country districts the young shoots are boiled and eaten, the injurious properties being quite destroyed by cooking. Pigs like nettles; and in Sweden they are used as fodder for cattle, and food for domestic poultry. In some parts of England, a kind of beer is made from the stalks and leaves, and gum and cloth are made from the fibre of the best. The roots, boiled with alum, yield a yellow dye; and a fine permanent green dye for woollen stuffs is obtained from the leaves and stalks. An Indian species (*U. tuberosa*) produces tubes, which are eaten like potatoes. The Tree-Nettle of Australia (*U. gigas*) ordinarily attains a height of about 30 feet, but specimens over 100 feet high have been met with.

NETTLE-TREE.—A genus (*Celtés*) of the natural order *Ulmaceæ*. The leaves resemble that of the common nettle, but are not stinging. It is a native of the south of Europe, Asia, and the north of Africa; grows to the height of 50 feet, and on account of its handsome appearance is planted on public walks in France and Italy. The fruit resembles a cherry, and the kernel yields a fixed oil. The wood is compact and bears a high polish, and is used for cabinetwork and musical instruments. There are many species natives of the hot regions of Asia and America.

NETTLE-RASH, *net'-tl-rash* (Lat., *urticaria*).—A disease characterized by a rash, or eruption of the skin, attended with intense itching, and taking its name from the close resemblance it bears to that produced by the stinging of nettles. There are two varieties of this disorder, one of which is regarded as acute, the other as chronic, and either persistent or intermittent. The acute form is usually preceded or attended with feverishness, and a feeling of general uneasiness, headache, nausea, and vomiting. It usually disappears entirely in six or eight days. The chronic form of this complaint is intractable and difficult to remove, coming and going for a lengthened period, but with little or no feverishness. In most cases, probably in all, this disease arises from some derangement of the stomach, and it may frequently be traced to the use of some particular articles of food—as shell-fish, oatmeal, mushrooms, &c. It is very rarely fatal, and the treatment is simple.

NEURALGIA, *nu-ral'-je-a* (Gr., *neuron*, a nerve; and *algos*, pain).—An increased and perverted sensation in a nerve, arising from some disease affecting the function or structure of the nerve or its centres. It is thus of two kinds: functional, when unconnected with organic lesion at any part of the nerve's course or at the nervous centres; or, as is more frequently the case, structural, connected with some organic change, acute or chronic, more frequently the latter, at some part of the nerve's course, or at the nervous centres. The causes of neuralgia are various, and generally obscure. They may be either constitutional or local; the former arising from some enfeebled state of the body or an impoverished condition of the blood, the latter from inflammation of the enveloping sheath of the nerves, or the development of tumours near or along their course. It may also be caused by the circulation of poisonous secretions, as urea, bile, &c., in the blood, or by the miasma of marshy regions. The pain is intense, but intermittent; sudden in its onset, and abrupt in its departure; shooting or plunging in its character, and often quite excruciating; readily excited by the slightest external impression. Tic-doloreux and sciatica are the most painful forms of the complaint. The treatment necessarily depends much upon the cause whence it proceeds. When it arises from an enfeebled or impoverished state of body, tonics, nourishing diet, and outdoor exercise are to be employed; and in the other cases the treatment has to be directed to removing the causes from which it springs. Where it depends on the pressure of tumours that can be removed, the pain will generally disappear with the removal of the cause. In inflammation of the nerve-sheath, local counter-irritation by cupping, blisters, issues, setons, &c., usually gives relief, and generally affects a cure. Temporary relief in all forms of neuralgia may be obtained by the administration of powerful anodynes, as morphine, used either externally or internally.

Neuritis, *neu-ri'-tis*, is the name given to a form of inflammation of the nerves, the symptoms of which nearly resemble those of neuralgia. It is a rare disease, and is generally caused by rheumatism.

NEUROPTERA, *nu-rop'-te-ra* (Gr., *neuron*, a nerve, and *pteron*, a wing).—One of the great classes into which the insect world is divided. It comprises the Dragon-flies, May-flies, Ant-lions, and Teronets, and similar species.

NEUTRAL BODIES, *nu'-tral*.—In Chemistry, neutral bodies are those which exhibit neither an alkaline nor an acid reaction, and which neither act as bases or as acids. In organic chemistry they are generally distinguished by the absence of the final *e* at the end of the word; such, for instance, as paraffin, naphthalin, stearin, salicin, benzol, and many others. They form their compounds by the displacement of one or more of those atoms by one or more atoms of some other substance.

NEWFOUNDLAND DOG, *nu'-found-land*.—A well-known and splendid variety of the canine race, remarkable for its strength, nobility of character, sagacity, and attachment to its master. There is no doubt that this dog derived its origin from the large Spanish dogs which were introduced into America by the early discoverers, and that from thence it was brought over to Europe. The natives of Newfoundland made them draw sledges and carts, and put them to other degrading uses. The rigours of the climate, and the difficulty of procuring food for the dogs, were, however, unfavourable both to the production of numbers and the full development of the frame. The English variety has been so cultivated that it is widely different, both in shape, size, and appearance, from the original stock, which is now extinct in Newfoundland. The dog is remarkable for its fidelity, intelligence, and courage, and is especially distinguished for its achievements in rescuing persons in danger of drowning.

NEWT, *nute*.—A small batrachian reptile, known also as the Eft, of the family *Salamandridæ*. There are many varieties, the principal one being termed the great or warty water-newt (*Triton palustris*), which when it is full grown, measures about six inches in length, and in its appearance greatly resembles the salamander. On the back the colour is a dark brown; the sides are speckled with spots, and the under-surface of the body is a bright orange, variegated with black patches. The head is rather small, and the eyes are of a bright golden hue; the tail is flattened in form, and has thin edges at the extremities; and the limbs are short, the fore-feet being divided into four, and the hind into five toes. The newt inhabits shady places and stagnant water, and lives principally on insects, of which it consumes an immense quantity. Besides the great water-newt there is the common (or smooth) water-newt (*punctatus*), smaller, with a smooth skin, gray and yellowish, spotted with black. Newts possesses the power of reproducing lost limbs. (*See* BATRACHIANS.)

NEWTONIAN SYSTEM. (*See* SOLAR SYSTEM.)

NEWTON'S RINGS.—Concentric coloured rings produced by Sir Isaac Newton by compressing an extremely thin film of air (about half a millionth of an inch in thickness) between two lenses, one convexo-plane, the other equi-convex. Coloured rings appeared, having the point of contact of the lenses for their centre, and increased in size when the pressure was increased. The rings formed seven systems, each composed of many smaller rings of different colours, in accordance with the colour of the spectrum.

NEW ZEALAND FLAX. (*See* PHORMIUM.)

NIARE, *ni-are*.—The wild ox or buffalo of Western Africa (*Bos brachicheros*), a native of the tropical regions. The horns, about a foot long are curved forward. The animal is very fierce if attacked.

NICKEL, *nik'-el*.—A metal discovered by Cronstedt in 1751, with a singular analogy to cobalt, being always associated with it in nature. Its principal ore is kupfernickel, which is the diarsenide of the metal. It is also extracted from nickel speiss, which is an impure arsenic-sulphide of nickel, left after the manufacture of cobalt-blue from its ores. Nickel is extensively employed in alloys, of which German silver is the most important. Pure nickel is a brilliant, silver-white ductile metal, nearly as infusible as iron, malleable, and capable of receiving a high polish. It is magnetic up to 660° Fahr., and becomes oxidized by exposure to a current of air at a high temperature. It is easily attacked by nitric acid and aqua regia, and slowly by sulphuric and hydrochloric acids. Its principal use is as a whitening agent in the manufacture of German silver. Added to aluminum in the proportion of 2 per cent., it hardens that metal without perceptibly altering its lightness. For chemical purposes it may be obtained in a state of purity by exposing oxalate of nickel to a high temperature in a closed crucible.

Nickel Glance.—A steel-gray ore of nickel, containing equal portions of the diarsenide and disulphide of nickel.

Oxides of Nickel.—With oxygen nickel forms two oxides—the protoxide and sesquioxide. The protoxide is obtained as an olive-green powder by igniting the carbonate in a covered crucible, and as a bulky green hydrate by precipitating its salts with potash. The protoxide forms numerous well-defined salts, mostly of an apple-green colour. The sesquioxide is a black powder, procured by treating the hydrated protoxide with chloride of soda. It does not combine with acids, but gives off a part of its oxygen when submitted to their action, and forms salts of the protoxide.

Salts of Nickel.—The principal salts of nickel are the sulphide, obtained as a black hydrate when a salt of nickel is precipitated by sulphide of ammonium; the chloride, formed by dissolving the oxide in hydrochloric acid—on evaporation, it yields green dydrated crystals, which, when submitted to a high temperature, sublime in crystalline yellow scales; the sulphate, formed by dissolving the oxide in sulphuric acid. It crystallizes in green rhombic prisms, which, on exposure to light, are converted without loss of water into octahedra. It is sometimes used in medicine as a tonic. With potash it forms a double salt.

NICKELINE, *nik'-el-een.*—The kupfernickel of the German miners. It is an important ore of nickel, and is found principally in Saxony, associated with cobalt, silver, and copper ores. It also occurs sparingly in Cornwall.

NICOTIANA, *ni-ko-she-a'-na.*—A genus of the natural order *Atropaceæ.* The species and varieties supply the different kinds of tobacco now in general use in some form or other all over the globe. (*See* TOBACCO.)

Nicotine, *nik'-o-teen.*—A volatile alkaloid contained in the tobacco plant, in which it occurs in combination with malic and citric acids. It is also contained in the smoke of the burning leaves. It is a limpid, colourless, oily liquid, with an irritating and powerful odour of tobacco. It is extremely poisonous, a single drop being sufficient to poison a large dog.

NIGELLA, *ni-jel'-la* (Lat.)—A genus of plants of the natural order *Ranunculaceæ.* The seeds of *N. sativa,* the common fennel-flower, were formerly employed instead of pepper. It is supposed that these seeds, or those of another species which are used by the Afghans for flavouring curries, are the *black cummin* of Scripture. Some varieties are named by rustics, "devil in a bush."

NIGHT, *nite* (Lat., *nox*).—That period of the earth's revolution on its axis during which the sun is below the horizon. (*See* DAY.)

NIGHT-BLINDNESS.—A peculiar affection of the eye, in which the patient sees very well during the day, but becomes blind as night approaches. It is mostly met with in warm climates, and usually gives way to mild treatment.

NIGHT-HAWK.—A bird (*Chordeiles Virginianus*) of the *Caprimuljedæ,* or goat-sucker family. It is about 9 inches in length, with wings expanding to nearly 24 inches. It is a native of North America, and a bird of passage, being met with as far south as the West Indies and the coast of the Gulf of Mexico in the winter, and in the Arctic regions in summer. The colour is brown, mottled and marked with white. It pursues its prey in the dusk of the evening and at early dawn, emitting a peculiar cry, somewhat resembling a sharp pronunciation of the word "piramidig," from which it has gained a popular name, and producing also, by the motion of its wings when rapidly descending, a peculiar booming sound. It is esteemed a delicacy for the table.

NIGHT-HERON.—A genus (*Nycticorax*) of the *Ardeidæ.* (*See* HERON.) The legs are shorter and the bill thicker than those of the common heron. The length from the tip of the bill to the end of the tail is about two feet; and the general colour is ash gray, with three long white feathers on the neck. It feeds chiefly in the evening or at night. The bird, which rarely visits this country, is very common in America. There are species in Africa and Australia.

NIGHTINGALE, *nite'-in-gail* (from Sax., *night,* and *galan,* to sing).—A well-known British songster (*Philomela luscivia*), unequalled in its note by any other specimen of the feathered tribe. The nightingale usually makes its appearance in this country about the middle of April, and the males arrive before the females. It is a familiar visitant to the southern and south-eastern countries, but is not heard in the west, and very rarely so far north as Yorkshire. On the continent, however, it migrates as far north as Sweden. The beak is brown; the irides hazel; the head and all the upper parts of the body and wings of a uniform brown colour, tinged with a reddish chestnut; all the under parts dull grayish-white in colour; the chin and the lower part of the breast of a lighter tint than the throat and chest; while the under tail-coverts are a pale reddish-white; and the legs, toes, and claws are brown. The whole length of the bird is about six inches and a half. The nest is made on the ground, or on a low bush. In all countries where the nightingale is known, from India and Russia in the east to Britain in the west, the beauty of its song has been a theme for the admiration of poets.

NIGHTMARE. (*See* INCUBUS.)

NIGHTSHADE. (*See* ATROPA.)

NIMBUS. (*See* AUREOLA.)

NITROGEN, *ni'-tro-jen* (Gr., *nitron,* nitre; *gennao,* I generate)—symbol N; equivalent, 14; density, 14; spec. grav., 0·9713—a transparent, colourless, permanent gas, well known as one of the constituents of the atmosphere, which contains volumetrically about 78 per cent., mechanically united with 22 per cent. of oxygen. French chemists name it *azote* (Greek, *a,* without; *zoe,* life), and German chemists term it *stickstoff,* such name expressing the idea that nitrogen alone will not support life. Although characterized by its inactivity when in a free state, it enters into combination with the other elements, forming compounds possessed of the most energetic properties. With hydrogen it forms ammonia; with oxygen, nitric acid; with carbon, cyanogen; with carbon, hydrogen, and other elements, an almost infinite number of bodies, known as the vegetable and artificial alkaloids, such as quinine, morphine, aniline, &c., &c. Besides these, most colouring matters contain nitrogen, and it is an essential constituent of the proximate principles of animal and vegetable bodies, such as albumin, fibrin, casein, &c. It was first called azote, from its incapability of supporting life; but Chaptal named it nitrogen, from its entering into the composition of nitre, nitric acid, &c. It is readily obtained in a variety of ways by abstracting the oxygen from the air. The easiest, perhaps, is by igniting a few pieces of phosphorus floating in a small capsule on water, and then covering the whole with a bell-jar. The remaining gas is then washed from the phosphoric acid with which it is contaminated, and passed over caustic potash, to remove any traces of aqueous vapour and carbonic acid. Thus obtained, it is a colourless uncondensable gas, tasteless, inodorous, and without action on vegetable colours. It is incombustible, and does not support combustion. It may be breathed with impunity as far as itself is concerned, but destroys life by preventing the inspiration of oxygen. Its compounds with the metallic elements are of little importance. Fulminating gold, silver, platinum, and mercury, are supposed to be nitrides of those metals; and a nitride of copper, Cu_6N, has been formed. The compounds it forms with the non-metallic elements are most numerous and important. From the similarity of their chemical characteristics, nitrogen, phosphorus, arsenic, antimony, and bismuth, have been formed by Gerhardt into a group termed by him the *Nitrogen group*.

NITRE, *ni'-ter* (Lat., *nitrum*), nitrate of potash, also known as potash. (*See* POTASH, NITRATE OF.)

NITRIC ACID. (*See* NITROGEN, OXIDES OF.)

NITRILE, *ni'-trile*.—In Chemistry, a name applied to artificial bases consisting of ammonia, in which the three equivalents of hydrogen are replaced by three equivalents of some other substance. Trimethylamine and triethylamine are examples of nitriles.

NOCTULE, *nok'-tule*.—The largest British species of Bat, *Vespertilio noctula*. (*See* BAT.)

NODE, *node* (Lat., *nodus*, a knot).—A term applied in astronomy to the point where the orbit of a planet intersects the ecliptic. The line in which the two circles intersect is called *the line of the nodes*. When the planet is in this line, in the act of passing from the south to the north side of the ecliptic, it is in its *ascending node*, and its longitude at that moment is the element called *the longitude of the node*.

In Surgery.—A hard tumour or swelling upon a bone, usually attended with little pain; but sometimes the pain is considerable, particularly in the night-time. The bones more particularly liable to it are those which are thinly covered with flesh.

Nodal Points, Lines and Sections.—Nodal points mark those portions of a string or metallic cord which alternately vibrate in opposite directions, the points remaining at rest. Nodal lines are those formed by sand on a plate of glass or metal, when a violin-bow is drawn across the edge. (*See* ACOUSTICS.) Nodal sections are the portions of a column of air in a wholly or partially-closed tube: when acted upon, the breath applied through a hole at any point of its length. Each section is separated from the others.

NODDY, *nod-de*.—A genus of birds very well known to sailors in tropical or sub-tropical regions in both hemispheres, and sometimes, but rarely, seen off the coast of Britain. They belong to the family *Laridæ*, but only one species, *Megalopterous stolidus*, is known. It resembles the gull in the shape of the beak, but is more similar to the term. It is about 15 inches long, and of a brownish-black colour. It frequently alights on vessels and permits itself to be caught by the hand, and in its breeding-place is readily caught, the hen not even quitting her nest at the approach of man. This over-confidence has gained for the bird its popular name, indicating unusual stupidity. It breeds in immense numbers on some of the small islands of the West Indies and in similar localities.

NOLANACEÆ *no-lan-ai'-se-e*.—A small natural order of herbs and shrubs in the class *Dicotyledones*, sub-class *Corolliforæ*. They are exclusively natives of South America, being most abundant in Chili.

NOLI ME TANGERE, *no'-li me tan'-je-re* (Lat., don't touch me).—A disease of the skin, commencing with small ulcerations, which destroy the part. It most frequently attacks the cartilage of the nose, and is very tedious and difficult of removal. (*See* LUPUS.)

NONAGON, *non'-a-gon* (Lat., *novem*, nine; Gr., *gonia*, an angle).—One of the regular polygons, possessing nine sides. When the side of a nonagon is 1, the area of the figure will be 6·1818242.

NON-CONDUCTOR. (*See* CONDUCTORS AND NON-CONDUCTORS, ELECTRICAL.)

NON-METALLIC ELEMENTS, *non-me-tal'-lik*. (*See* ELEMENTS.)

NORTHERN LIGHTS. (*See* AURORA BOREALIS.)

NORWICH CRAG, *nor'-ritch*.—A series of fossiliferous beds of sand, loam, and gravel, known also as Mammaliferous crag, in the neighbourhood of Norwich. The fossils are of the Pleistocene age, and include the bones of a species of elephant, the horse, deer, and other mammalia, ichthyolites, and marine and fresh-water molluscs.

NOSE, *noze* (Sax., *næse*, *nosa*).—The organ of smell in vertebrated animals, and in the three highest classes is connected with the respiratory function. The nose, anatomically considered, consists of two large cavities called nostrils (*nares*), a right and a left, formed by the bones of the face, and separated from each other by a perpendicular flat partition called the *septum narium*. There are fourteen bones which enter into the composition of the cavities of the nose; the principal of which are the nasal bones, which bound the nasal cavities in front, and are attached to the frontal bone above and to the superior maxillary on the sides. The upper wall of the nose is pierced by numerous foramina, through which enter the filaments of the olfactory, or nerve of smell. The mucous membrane lining the nose is called the *schneiderian*, or *pituitary*, and is continuous with the common integument anteriorly, and with the mucous membrane of the pharynx posteriorly. It is, for the most part, well supplied with vessels, especially veins, and presents also numerous glandular follicles, whose secretion is well known. It receives the filaments of the nerves of smell and of common sensation. The openings of the nose are provided with stiff, curved hairs, which prevent the entrance of many particles floating in the air. The external prominent part of the nose, which gives character to the feature, is composed of several cartilages connected to the bones and to each other by strong, fibrous tissue, sufficiently firm to preserve the shape of the organ, and so elastic and flexible as to permit the expansion and contraction of the nostrils in respiration. The varying expression given to the face by the movements of the nose depends on the action of its muscles attached to the cartilages, skin, and upper lip; and most of the expressions arising from these movements are disagreeable, indicating contempt, anger, fear, or pain.

NOSOLOGY, *no-sol'-o-je* (Gr., *nosos*, a disease, and *logos*, a discourse).—A term generally applied to the methodical arrangement and classification of diseases and their nomenclature. The arrangement now generally adopted is that of Dr. Farr, of the Registrar General's Office, who comprised diseases in four classes, each including several orders: I. *Zymotic*, such as are epidemic, endemic, or contagious, induced by some specific body, by want of food, or by its bad quality; II. *Constitutional*, sporadic diseases affecting several organs, in which new morbid products are often deposited; III. *Local*, in which the functions of particular organs or systems are disturbed or obliterated; IV. *Developmental*, special diseases, the incidental result of the formative, reproductive, and nutritive processes.

NOSTALGIA, *nos-tal'-je-a* (Gr., *nosteo*, I return, *algos*, pain).—A term applied to an intense longing for return to one's own native country. This vehement home-sickness is attended with melancholy, loss of appetite, and want of sleep.

NOSTOC, *nos'-tok.*—A genus of *Algæ* or sea-weeds, sub-order *Confervaceæ*. *N. edule* is eaten in China and Japan. *N. arctium* is a valuable article of food in the Arctic regions, and is said to be more nutritious than Iceland moss. In this country, *N. Commune* frequently appears suddenly after heavy rains. It is a gelatinous moss; and in accordance with an old belief that it fell from the sky, is popularly known as star jelly.

NOTORNIS, *no-tor'-nis.*—A genus of birds of the family *Rallidæ*, nearly allied to the coots, but larger. Only one species, *N. Mantelli*, of New Zealand, is known. It is very rarely met with, and only in the Middle Island. The flesh is described as delicious.

NUCLEOBRANCHIATA, *nu-kle-bran-ki-a'-ta.*—An order of gasteropods having the sexes distinct, known also as heteropoda. They are all marine, and generally swim with the back downwards and the fin-shaped feet upwards. They adhere to sea-weed by small suckers placed on the fins. Some of the species have the bodies protected by shells, others have small shells covering the gills and heart only, and some are destitute of shells.

NUCLEUS. (*See* CELLS.)

NUDIBRANCHIATA, *nu-de-bran-ki-a'-ta* (naked gilled).—An order of gasteropods, destitute of shells, with the gills exposed on the surface of the body. They are hermaphrodite. (*See* DORIS.)

NUMERATOR, *nu'-me-ra-tor*, a term applied in mathematical science to that part of a fraction which expresses into how many parts the unit is divided. (*See* FRACTIONS.)

NUMMULITE LIMESTONE (Greek, money-fossil).—A limestone belonging to the middle Eocene period (*see* GEOLOGY), composed of fossil foramenifereæ, circular shells of small size, composed of a series of small chambers arranged in a concentric manner. In Egypt, where they are very abundant, they are popularly known as "Pharoah's pence." About 50 species are known. The strata are generally of immense thickness and breadth.

NUT.—A fruit which has the seed enclosed in a hard shell, which does not open when ripe, or, more strictly, in botanical language, a nut, or *nux*, is a one-celled fruit with a hardened pericarp, containing only one seed. Nuts vary in size, from the small hazel-nut, or filbert, to the large cocoa-nut. Many nuts, as the hazel, Brazil, chestnut, and cocoa-nut, are edible; others are of value in medicine and the arts, and some yield useful oil. Immense quantities of nuts are imported into this country from Spain, Italy, France, Syria, and South America.

NUT-CRACKER.—A genus of birds (*Nucifraga*) of the family *Corvidæ*, having some resemblance to the crows, but more nearly allied to the jays, and, in some respects, to the woodpeckers. One species (*N. casyocalactes*) is common in the wooded mountainous regions of Europe and Asia, and is occasionally seen in Britain. It is about the size of a jackdaw, generally of a light brown colour speckled with white, but with dark wings and tail.

NUT-HATCH.—A genus of birds (*Sitta*) of the family *Certhiadæ*. It feeds on insects, seeds, and the kernels of nuts, in search of which it runs up and down the bark of trees with great activity, aided by short legs and very strong hind toes. It places a nut in a crevice in the bark, and pecks at it with its powerful conical bill until the shell is broken, giving force to the stroke by a movement of the whole body; and from that mode of obtaining its food, gained the old form of the name, "nut-hack." One species, known as the European Nut-hatch, about six inches long, is common on the continent and in wooded districts in this country. In North America, the genus is very abundant; and similar birds are found in Australia.

NUTATION, *nu-ta'-shun.*—A slight oscillatory movement of the earth's axis, disturbing the regular circular path described by the pale of the earth round the ecliptic, known as "the precession of the equinoxes." It is caused by the attraction of the sun and moon.

NUTMEGS. (*See* MYRISTICA.)

NUTRITION, *nu-trish'-un* (from Lat., *nutrio*, I nourish).—That complicated process by which a perpetual course of reproduction is going on in every part of the system, the component particles of the various tissues—bone, muscle, nerve, &c.—which are disintegrated and removed by the vital acts of the organism, being constantly replaced by new matter capable of continuing the functions necessary to life. In order to this, a due supply of proper food is necessary, the nutritious particles of which, after being digested, are absorbed, converted into healthy blood, and circulated over the system. The effete matter is removed by the organs of excretion, or modified by the purifying action of the lungs. (*See* PHYSIOLOGY, DIGESTION, BLOOD, &c.)

NUX-VOMICA. (*See* STRYCHNOS.)

NYCTAGINACEÆ, *nik-taj-e-nai'-se-e.*—The Marvel of Peru family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*. Some are annual or perennial herbaceous plants, some shrubs and trees. There are 17 genera and about 100 species, natives exclusively of warm regions. Some are cultivated as garden ornaments, on account of the beauty of their flower, especially the genus *Mirabilis*, which includes the Marvel of Peru. The roots of some species are purgative and emetic. (*See* MIRABILIS.)

NYCTALOPIA, *nik-ta-lo'-pe-a* (from Gr., *nux*, night; *ops*, vision).—The faculty of seeing best at night. A person suffering from this defect of vision sees little or nothing during the day, but in evening and night has his vision tolerably unobscured.

NYCTANTHES, *nik-tan'-theez* (Gr., *nux*, night; *anthos*, flower).—A genus of the natural order *Jasminaceæ*, remarkable for the flowers expanding and smelling only in the night. *N. arbor tristis* is often grown in English hothouses. In India its flowers are used for dyeing yellow.

NYCTERIBIA, *nik-ter-ib'-i-a.*—A genus of insects, generally included in the order *Dipteria*, but differing considerably from other members of the order, and more nearly resembling the sheep-tick. They have no wings, and have a spider-like appearance. They live chiefly on the blood of bats, on which all the species are parasitic.

NYLGHAU, *nil'-gaw.*—The white-footed antelope, *Antilope picta*, is found in Northern India and the borders of Persia, where it frequents the vast jungles which cover those regions, and it is one of the largest and finest antelopes there, being more than four feet high at the shoulders. It is dark gray, that colour being composed of thin coats of hair, black, brownish, and white. The horns of the male are seven or eight inches long, and are curved forwards. The legs, which like the head are darker in colour than the body, are commonly marked by a transverse white mark in front, and by a second patch opposite the accessory hoofs on the inner side. There are a slight mane and a long tuft of hair hanging from the neck. The females are of a fawn-colour, are less in size than the males, and are deprived of horns. The nylghau is hunted in the usual manner in which game is taken in the East, by surrounding them in fences, or with nets, and killing them at pleasure. It is a courageous and dangerous animal, but is sometimes domesticated.

NYMPHÆACEÆ, *nim-fe-ai'-se-e.*—The Water-lily family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*. The plants of this order are chiefly found in quiet waters, throughout the whole of the northern hemisphere; they are, generally speaking, rare in the southern hemisphere. They have bitter and astringent properties. Many contain a large quantity of starch, both in their rhizomes and seeds; hence, these parts are often employed as food. They are remarkable for their large showy flowers.

NYSSA. (*See* ALANGIACEÆ.)

O.

OAK. (*See* QUERCUS.)

OAK-APPLE, *oke'-ap-pl*, a spongy excrescence found upon the twigs of the *Quercus pedunculata*. It is formed by the puncture of a cynips, and rises rapidly, being usually spheroidal in form, and about one to two inches in diameter. The oak-apple must not be confounded with those beautiful little excrescences so common on the underside of the leaves of the oak, and known by the names of *galls* and *spangles*. They are also produced by the puncture of different species of cynips. Oak-apples are very astringent, containing tannic acid, and are used both for making ink and for dyeing and staining.

OAK-BEAUTY.—A moth (*Biston prodomaria*), the caterpillar of which feeds on the oak. It belongs to the family *Geometridæ*, and is a native of England. It measures nearly two inches in expanse of wings, and has brown bands.

OASIS, *o-a'-sis*, plural *oases*, cultivated spots in a desert, due to the presence of springs of water issuing from the ground.

OAT, *ote* (*Avena*).—A genus of grasses bearing the grain known as the oat, which is largely cultivated, especially in Scotland, for food. There are many varieties, some being only useful for hay.

OBESITY. (*See* CORPULENCE.)

OBSIDIAN, *ob-sid'-e-an* (said to be named after Obsidius, a person who first found it in Ethiopia).—A vitreous lava, produced in large quantities during volcanic eruptions by the melting of pumice-stone. It is a true glass, closely resembling furnace slag, and consists of silicate of alumina, with varying percentages of soda, potash, lime, and oxide of iron. It is generally black or dark gray, with occasional crystals of felspar dispersed through its mass. It occurs in streams or detached masses near volcanoes, and is used by savage nations for making mirrors, axes, knives, &c. It often graduates into pumice-stone.

OCCIPUT. (*See* BRAIN, ANATOMY.)

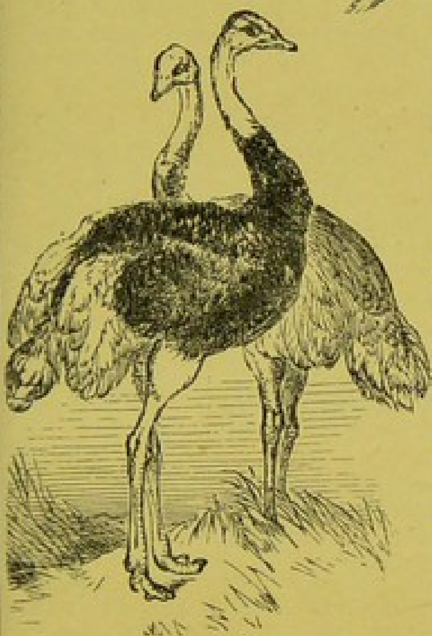
OCCULTATION, *ok-kul-tai'-shun* (Lat., *occulto*, I conceal.)—The phenomenon which occurs when a star or planet becomes hidden from view by the interposition of the moon or another planet.

OCEAN, OR SEA, *o'-she-an* (Fr., *océan*, Lat., *oceanus*).—The general name given to the whole volume of water which occupies the lower part of the surface of the world and surrounds the mainland on all sides. The surface of the earth is made up of 148,480,000 geographical square miles, and of these the ocean occupies 109,696,000 geographical square miles, thus covering more than two-thirds of the whole area of the mainland. (*See* PHYSICAL GEOGRAPHY.)

OIL PALM.

NIGHTINGALE.

WOODY NIGHTSHADE.



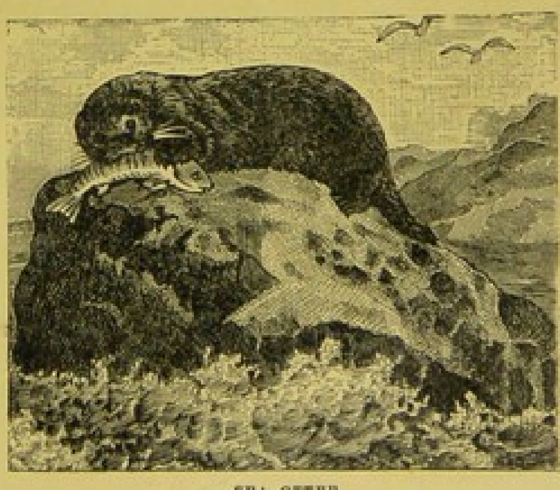
OSTRICHES.

OURANG-OUTANG.

OWL.

OCELOT.

OPOSSUM



SEA OTTER.

OCELOT, *o'-se-lot* (Fr.).—The name given to several species of *Felidæ*, slightly smaller than the ounce (which *see*). The length of a full-grown ocelot is from three feet and a half to four feet, including its tail, which is between eleven and fifteen inches. The colour is tawny, with dark brown or black spots. Specimens of it have been brought from Mexico, Brazil, Guiana, and Surinam, where it inhabits the forest and climbs trees in search of its prey, which consists of birds and small animals. The linked ocelot (*Felis catenata*) is a variety about the size of a wild cat. The long-tailed ocelot (*Felis macrourus*) is another variety, and is characterized by the length of its tail.

OCHNACEÆ, *ok-nai'-se-e* (Gr., *ochne*, the pear-tree).—A natural order of *Dicotyledones*, sub-class *Thalamifloræ*, consisting of under-shrubs or smooth trees. The *Ochnaceæ* are natives chiefly of the tropical parts of India, Africa, and America. They are generally remarkable for their bitterness. Some, as *Gomphia jabotapita*, yield oil suitable for salads.

OCHRES, *o'-kers.*—The name given to certain clays coloured with oxide of iron. When calcined, a greater depth of colour is obtained by increasing the degree of oxidation of the iron.

OCHROMA, *ok-ro'-ma* (Gr., pallid hue).—A genus of the natural order *Sterculiaceæ*. The species *O. lagopus*, a West-Indian tree, has an antisyphilitic bark, and spongy wood, which is sometimes used as a substitute for cork.

OCTAGON, *ok'-ta-gon* (Gr., *okto*, eight, and *gonia*, angle).—A plane figure in Geometry contained by eight sides, and therefore possessing eight angles. If these angles and sides are equal to one another, then the figure is a *regular polygon*.

OCTAHEDRON, *ok-ta-he'-dron.*—A solid figure having eight triangular sides, thus having twelve edges and six angles. Crystals of silver assume this form. The figure resembles two equal pyramids, with equilateral triangles for their sides, placed base to base.

OCTOPODA, *ok-to'-po-da* (Gr., eight-footed).—A section of the dibranchiate cephalopods. (*See* CEPHALOPODA.)

OCTOPUS, *ok'-to-pus.* (*See* POULPE.)

OCYMUM, *o'-se-mum* (Lat., *ocimum*).—Sweet basil, a genus of plants belonging to the natural order *Labiatæ*. It is supposed to owe its name to the powerful fragrance for which several of the species are remarkable. The leaves of some of the species are used as an ingredient in savoury dishes, and *Ocymum febrifugium* of Sierra Leone is used as a febrifuge.

OD, OR ODYL, *od'-il* (probably from a Scandinavian word meaning "all-pervading").—The name given to a supposed universal force in nature, which Baron von Reichenbach claims to have discovered in 1844. According to the discoverer, it pervades all nature, and is akin to electricity, magnetism, light, &c. It has two poles, like electricity and magnetism—a positive and a negative, which appear in all organic substances; the human body, for example, being positive on the left side and negative on the right. Its rays pass through all kinds of matter, and can be felt and seen by certain persons called sensitives, who have a peculiar nervous sensibility; but the majority of mankind are non-sensitives, and insensible to odic influences. A similar force was believed in by Emanuel Swedenberg.

ODONTALGIA, *o-dont-al'-je-a.* (*See* TOOTHACHE.)

ŒDEMA, *e-de'-ma* (Gr., *oideo*, I swell).—A swelling occasioned by the infiltration of serum into the areolar tissue of any portion of the body. It is generally a symptom of some internal disease, the effusion of serum being caused by some obstruction to the return of venous blood to the heart.

ŒNANTHE, *e-nan'-the* (Gr., *oinos*, wine; *anthos*, flower).—A genus of the natural order *Umbelliferæ*. The indigenous species *Œ. crocata*, the drop-wort or dead-tongue, and *Œ. Phellandrium*, the fine-leaved water-dropwort, are intensely poisonous in most localities. The roots of *Œ. pimpinelloides* are said to be wholesome. These species are often improperly called hemlock.

ŒNOTHERA, *e-no-ther'-a.*—A genus of the natural order *Onagraceæ*. The Evening Primrose (*Œ. biennis*), with large yellow flowers, which become fragrant in the evening, was introduced into this country from Virginia in 1814. The root, resembling a carrot in shape, is edible, and used in soups and salads. The roots of other species are also edible.

ŒSOPHAGUS, *e-sof'-a-gus* (Gr., *phero*, *oiso*, I carry, and *phago*, I eat).—The gullet, or the membraneous tube leading from the pharynx to the stomach, and forming the passage through which the food descends into the latter organ. Its length is about nine inches, and its direction nearly straight, having only two or three slight curvatures. Its walls are composed of three coats—an external or muscular, a middle or areolar, and an internal or mucous coat. In the neck, the œsophagus lies immediately behind the trachea.

ŒSTRIDÆ, *e-stri'-de.*—A family of dipterous insects closely resembling flesh-flies, and nearly allied to the *Muscidæ*. They are the parasites of certain animals, and their eggs are deposited in the skin of the quadruped they infest.

OGYGIA, *o-gi'-jia.*—A genus of Trilobites of which only six species have been described at present. They belong to the Lower Silurian period.

OHM'S LAW, *ome.* (*See* ELECTRICITY.)

OIDIUM, *o-id'-i-um.*—A genus of fungi, consisting of minute tubular threads which grow on diseased animal and vegetable substances. *Oidium Tuckeri* is the disease which has recently caused such devastation among the vines both in England and on the Continent.

OIL PALM.—A palm (*Elais Guineensis*) very abundant in the equatorial regions of Africa. It sometimes attains a height of 90 feet, but the average is about 50 feet. The leaves are feathery. The stems support many vegetable parasites, ferns, shrub-like fig-growths, and orchids. Convolvuli and gums have a share in the drapery of the stem, while all kinds of common shrubs and trees strive to shoot forth from the reservoirs of water deposited by the rain within the hollow of the leaves. The blossoms of the palm are of two sexes: the male flower hanging in long clusters, the female in globular ones, of which the palm bears three or four a year, the fruit developed weighing from 40 to 60 lbs., and, in some instances, considerably more. The best oil is obtained from the flesh of the fruit, a thick fluid of a pale vermillion colour. The fruit is allowed to lie until it begins to rot, and is then beaten with clubs, until the oil flows into a trench; or the fruit is left to rot under a course of watering with boiling water, and then the oil is collected from the surface. A considerable trade is carried on by the natives in the export of the oil and the palm kernels.

OITI, *oi'-te.*—A Brazilian tree (*Moquilea tomentosa*), of the natural order *Chrysobalanaceæ.* The timber is of value for ship-building.

OLACACEÆ, *ol-a-kai'-se-e.*—The Olax family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*, trees or shrubs, natives of tropical or sub-tropical regions. Some are remarkable for their fragrant flowers. The leaves of *Olax zeylanica* are used in salads, and the wood as a medicine for putrid fevers. The fruit of *Ximenia Americana* is commonly eaten in Senegal.

OLDENLANDIA, *old-en-lan'-de-a* (in honour of H.B. Oldenland, a Danish botanist).—A genus of the natural order *Cinchonaceæ.* The root of the species *O. umbellata* forms the so-called *chay* or *che root*, which is occasionally im ported from India, and used for dyeing red, purple, and orange-brown.

OLD RED SANDSTONE.—A name given by geologists to a series of Palæozoic rocks composed chiefly of red sandstone, but containing other sandstones, clay, and limestone; and situated between the Silurian and carboniferous beds. (*See* GEOLOGY.) Old red sandstone occupies a large portion of Great Britain, and is very prominent in the northern part of the United States and Canada. The lower margin of the system is characterized by strata containing the fossil remains of ganoid fishes, and forming a line of separation between it and the Silurian system. On its upper margin it is distinguished by the rarity of the vegetation which so remarkably distinguishes the overlying carboniferous rocks. The great bulk of the system consists of a succession of sandstones alternating with subordinate layers of sandy shales and beds of concretionary limestone. The sandstones pass in fineness from close-grained fissile flags to thick beds of coarse conglomerate, and the shales from sandy, laminated clay, to soft, flaky sandstone. Oxide of iron tinges the whole of the system more or less with a colour varying from a dull, rusty gray to bright red, and from red to a fawn or cream-coloured yellow. The whole system is usually divided into three great groups—Upper, Middle, and Lower.

OLEACEÆ, *o-le-ai'-se-e.*—The Olive family, a natural order of *Dicotyledones*, sub-class *Corolli-floræ.* Trees or shrubs flourishing in temperate regions, but a few occurring in the tropics. There are about 150 species, including the olive, ash, lilac and privet, and other well-known plants which have little external resemblance, but which can be grafted one on the other, as the olive or lilac on the ash. The barks of many are tonic and febrifugal. The mild purgative called *manna* is obtained from several species. The wood of some is hard and durable. The olive is the most valuable member of the family. (*See* OLIVE.)

OLEANDER, *o-le-an'-der.*—A genus of plants (*Nerium*), of the natural order *Apocynaceæ*, evergreen shrubs. The common Oleander (*N. oleander*) is a native of the warmer temperate regions of the old world, and is known in this country as Rose Bay and in France as *Laurier Rose.* It grows to a height of about nine feet, and has beautiful red or white flowers. It is most abundant in moist soils. A poisonous, bitter, and narcotic acid flows when young twigs are broken off. In France, a decoction of the leaves or bark is used as a remedial lotion in cutaneous diseases. The fibre of the bark of one Indian species (*N. piscidium*) is used as a substitute for hemp.

OLEOPHOSPHORIC ACID, *o'-le-o-fos-fo'-rik.*—A yellow viscid substance which, according to some chemists, exists in the brain, spinal cord, liver and kidneys.

OLIBANUM, *o-lib'-a-num* (Gr. *libanos*, the Frankincense-tree).—A fragrant gum-resin, chiefly used as a fumigation. Indian olibanum is the produce of *Boswellia thurifera*, but African or Arabian olibanum is supposed to be derived chiefly from another species—*B. floribunda.* This resin is the *lebonah* of the Hebrews, and the incense or frankincense of the Bible. (*See* BOSWELLIA.)

OLIVE, *ol'-iv.*—A genus (*Olea*) of the natural order *Oleaceæ.* The common Olive (*O. Europæa*) is a native of the south-western parts of Asia, and is naturalized in the south of Europe. When cultivated, it grows to a height of 30 or 40 feet, although only a thorny shrub in its wild condition. The leaves, lanceolate in shape are of a dull green colour on the upper surface, scaly and of a bright gray colour underneath. The fruit, about the size of a damson, varies in colour, being green, white, violet or black; and is very abundant. Olives, having been steeped in lime water, or otherwise prepared, are eaten to renovate the taste and are presumed to promote digestion. Very few persons like them at first, but the flavour greatly improves on acquaintance. Olive oil is in great favour as an article of food in the countries where olives are cultivated, and is exported for medicinal and other uses. The bark of the tree is bitter and astringent, and, as also the leaves, is occasionally used as a febrifuge. The gum exuding from old stems is used in perfumery in Italy, the odour resembling that of vanilla. The wood of the root, beautifully marked, is of value in the manufacture of small ornamental articles, and the wood of one South African species is so hard that it is locally known as ironwood. The wood of the American olive is also remarkable for its hardness. The flower of a species cultivated in China and Japan are very fragrant, and are used for flavouring tea. The olive tree attains a great age.

OLIVINE, *ol'-e-veen.*—A semi-transparent olive-coloured mineral, found in grains and crystals in many basalts and lavas. It is a silicate of alumina, with varying proportions of soda, potash and lime. The transparent varieties form the precious stone known as chrysolite.

OLIVENITE, *ol'-i-ven-ite.*—A mineral found with ores of copper in Cornwall and other places. It is composed chiefly of arsenic acid and protoxide of copper, with a little phosphoric acid.

OMPHALEA, *om-fai'-le-a* (from Gr., *omphalos*, the navel, from the remarkable umbilicated form of the seed-cases).—A genus of the natural order *Euphorbiaceæ*. The only remarkable species is *O. triandra*, the juice of which is sometimes employed in Guiana as a substitute for black ink.

OMUL, *o'-mul.*—A fish (*Salmo migratorius*) of the salmon tribe. It averages about 15 inches in length, and has white and delicate flesh. It abounds in the lakes of Western Siberia.

ONCOCARPUS, *on-ko-kar'-pus.*—A genus of trees of the natural order *Anacardiaceæ*. A very fine species (*O. atra*) is a native of the Fiji Islands. It attains a height of about 60 feet. The sap of the fruit, on coming in contact with the skin, produces a burning sensation; and the exhalation from the sap of the tree causes great itching and irritable pustules, often lasting for a long period. From this peculiarity, the tree is popularly known as "itch-wood."

ONION, *un'-yon* (Fr., *oignon*).—A species of the genus *Allium* (which *see*), known as *A. cepa*, and the name is also popularly given to other species of the same genus. The onion is a biennial, bulbous-rooted plant, of great value as an edible, either eaten raw or as an ingredient in soup and made dishes, or pickled. It has been cultivated in the East from remote antiquity. The flavour and odour, very disagreeable to some persons, are due to a volatile, sulphurous oil, which is partially dissipated by boiling. The use of onions stimulates the organs of secretion; and onions roasted with oil make a valuable poultice for tumours.

ONOPORDUM, *on-o-por'-dum.*—A genus of the natural order *Compositæ*. *O. acanthium* is the Scotch thistle of gardeners. It is also known under the name of the cotton thistle.

ONYX, *o'-niks* (Lat.).—A variety of agate, containing alternate layers of white, brown, and black; much used as an ornamental stone by jewellers.

ONYX MARBLE.—A stalagmite formation, consisting of a translucent limestone, with traces of magnesia and carbonate of iron. It is found in Algeria, and is used in the manufacture of ornamental articles.

OOLITE, *o'-o-lite* (Gr., *oon*, an egg; *lithos*, stone).—A variety of limestone, so called from its being composed of small rounded grains, resembling the eggs or roe of a fish. Each grain has generally some minute fragment of sand as a nucleus, round which concentric layers of calcareous matter have accumulated. The term *roe-stone* is applied to it when the grains are very distinct and well-rounded, and *pisolite*, or peastone (from Lat. *pisum*, a pea), when the grains are large and pea-like.

OOLITIC, OR JURASSIC SYSTEM, *o-o-lit'-ik.*—In Geology, a formation which derives its name from the prevalence of limestones of an oolitic texture as developed in England, or from the Jura Range of mountains, as exhibited typically on the Continent of Europe. The oolitic system may be said to comprehend the whole of those peculiar limestones, calcareous sandstones, marls, shales, and clays, which lie between the chalk formation and the new red sandstone beneath. Where the system is perfect and complete, the argillaceous laminated limestone and shales, called the *Lias*, constitute the lowest group; the yellowish, granular limestones, calcareous sandstones, sands, and clays, called *Oolite*, the middle group; and the grayish, laminated clays, with subordinate layers of limestone, and flaggy, ferruginous sandstones, called the *Wealden*, the upper group. (*See* GEOLOGY.)

OOTRUM, *oot'-rum.*—A fibre obtained from the stem of the *Demia extensa*, a plant of the order *Asclepiadiaceæ*, growing in various parts of India. It is white, silky, and strong, and has been used as a substitute for flax.

OPACITY, *o-pas'-e-te* (Lat., *opacus*, dark).—A condition of bodies which renders them opaque, or incapable of transmitting light. This quality appears to depend upon the nature or disposition of the particles of bodies, but its precise cause is as yet imperfectly understood.

OPAH, *o'-pa.*—A fish (*Lampris guttatus*) of the Dory family, known also as the King-fisher, chiefly found in the northern regions of the Atlantic and on the coasts of China and Japan. It is about five feet long, of a narrow oval form, and very beautifully coloured, the back and sides being of a rich green, giving purple and golden reflections, a lighter green on the lower parts, with fins of a bright vermillion hue. The flesh resembles that of salmon in colour and flavour, and is considered a delicacy.

OPAL, *o'-pal* (Lat., *opalus* or *opalum*).—A precious stone, consisting principally of silica, with a small admixture of alumina; much valued as a gem, from the beautiful play of colours it exhibits, caused by an infinite number of minute pores or fissures existing in its mass. The finest kind is known as Precious, or Oriental Opal. The most valuable known to be in existence is in the Imperial Cabinet at Vienna. It measures five inches by two and a half. The finest stones of this kind are found in Hungary.

Wood Opal is a petrifaction exhibiting the form and structure of wood, the place of which has been taken by siliceous mineral.

Prime d'Opal is clay-porphyry, or other stone containing many small grains of opal, which is cut into slabs and used for making ornamental articles.

OPEN-BILL.—A genus of birds (*Anastomus*) of the Heron family, which frequent the sea coasts of the East Indies and Africa, and prey on fish and reptiles. They are remarkable for the construction of the bill, the mandibles of which are only in contact at the base and the tip, with a wide interval between their edges in the middle.

OPERCULUM, *oper'-ku-lum* (Lat., a lid).—In Botany, the covering of the mouth of the capsule, which contains the spore of mosses. In Zoology, the term denotes the covering of the mouth of the shell in many gasteropod molluscs.

OPHELIA, *o-fe'-le-a* (Gr., useful).—A genus sometimes called *Agathotes*, of the natural order *Gentiana*. The species *O. chirata* is the medicinal herb known as chiretta or chirayta, which is used by the natives of India as gentian is employed in Europe. The dried plant and root possess great bitterness, and are used to some extent in this country for the sake of their tonic properties.

OPICEPHALUS, *o-pi-sef'-a-lus.*—A genus of fishes of the family *Anabasidæ*, eel-like in form and covered with large scales. Some are common in the East Indies, and are eaten by the natives.

OPHIOCARYON, *of-e-o-kai'-re-on* (Gr. *ophis*, a serpent; *karuon*, a nut).—A genus of the natural order *Sapindaceæ*. *O. paradoxum* is the snake-nut-tree of Demerara, so called from the large embryo of its seed resembling a coiled-up snake.

OPHIOGLOSSUM, *of-e-o-glos'-sum* (Gr., *ophis*, a serpent; *glossa*, a tongue).—A genus of fern, forming the type of the sub-order called *Ophioglosseæ*. The British species *O. vulgatum* is the common adder's tongue. It has long been employed as a vulnerary, and in some districts is much used in the preparation of a popular ointment.

OPHIUCHUS, *o-fi-u'-kus*.—The name given by Ptolemy to one of the northern constellations. (*See* SERPENTARIUS.)

OPHTHALMIA, *of-thal'-me-a* (Gr., *ophthalmos*, the eye).—An inflammation of the eye. Under this head may be included inflammation of all the various parts that enter into the formation of the eye. General ophthalmia is of very rare occurrence, the disease being in the great majority of cases confined to some one of the parts, and having a distinct name; as conjunctivitis, iritis, or corneitis, denoting inflammations of the conjunctiva, iris, or cornea, respectively. The most frequent form of ophthalmia is inflammation of the conjunctiva, or white of the eye. It may be caused by the presence of any irritating body, and is frequently produced by cold, when it is known as catarrhal ophthalmia. In it the eyes are bloodshot, the redness being produced by injection of the net-work of vessels which covers the white of the eye; the lids are swollen, with a good deal of smarting and itching, and a feeling as if there were sand or other foreign body in the eye. A much more severe form of the disease is purulent ophthalmia, or, as it is frequently called, Egyptian ophthalmia, from its having been brought into this country by the army returning from the expedition to Egypt during the wars of the first Napoleon. In this all the symptoms of the preceding are greatly aggravated. Infants of a few days old are often subject to a very severe form of inflammation of the conjunctiva, to which the name of *ophthalmia neonatorum* (ophthalmia of new-born infants) has been given. In mild cases, bathing or cleansing the eye several times a day with a weak warm solution of alum may be all that is necessary; in severe cases a leech should be applied to the temples, purgatives administered, and a weak solution of nitrate of silver applied to the eye daily. *Strumous* or *scrofulous ophthalmia* occurs in children of scrofulous habit, and is chiefly remarkable for the extreme intolerance of light by which it is accompanied.

OPIUM, *o'-pe-um* (Gr., *opos*, juice).—The inspissated juice of a species of poppy (*Papaver somniferum*), originally a native of the East, but now naturalized throughout most of Europe. Opium is the most energetic of narcotics, and one of the most valuable of all medicines. In procuring relief from pain at all times, it is invaluable. It is an efficient remedy in cholera, spasmodic affections, convulsions, tetanus, neuralgia, &c. It is most commonly used for the purpose of procuring sleep; but its habitual use is attended with very pernicious effects. A full dose is exhilarating; but if taken in large quantities, it produces dangerous and fatal results. Laudanum is a liquid preparation of opium made with alcohol, and its effects on the human system are similar to those of opium. (*See* LAUDANUM.) The principal countries in which opium is prepared are India, Turkey, and Persia, the best-esteemed opium being that obtained from Turkey. The opium of commerce is in masses of different sizes. It is rather hard, brown in colour, and possesses a bitter, acrid, and nauseous taste. Its odour is characteristic, and when heated in the air, it kindles, but does not burn readily. Its analysis shows that it contains acidulous meconate of morphia, extractive matter, mucilage, fecula, resin, fixed oil, caoutchouc, a vegeto-animal substance, débris of vegetable fibres, occasionally a little sand, together with a white crystalline salt of opium, known as *nicotines*.

Opium Alkaloids.—*Morphine*, *codeine*, *papaverine*, *narcotine*, *thebaine*, *narceine*, and *meconine*, all of which form well-marked salts with the acids. Opium also contains *meconic* and *thebolactic* acids. These principles are extracted from opium by a very simple process. Chloride of calcium is, therefore, added to the aqueous solution, by which means the more easily crystallizable hydrochlorates of the biases are formed in the liquid, and meconate of lime s precipitated. From the clear solution the hydrochlorates of morphine and codeine crystallize first, leaving the others dissolved in the mother liquor. The morphine and codeine salts are separated by solution in water, to which excess of ammonia is added. Morphine is found in opium in combination with meconic acid. In the pure alkaline state it crystallizes in shortt rectangular prisms, soluble in 1,000 parts of cold ando400 of boiling water. The solution has an intensely bister taste, and turns yellow turmeric-paper to a deep br wn. Boiling alcohol dissolves it abundantly, but it i insoluble in ether. Morphine is a powerful sedative and is much used in medicine, either in the form of hydrochlorate, acetate, sulphate, or citrate, the first-named being the most frequently used.

OPOSSUM, *o-pos'-sum*.—An anim l (*Didelphis*) belonging to the family of *Mammalia* in the animal kingdom, and its section *Marsupiata*, and it is a native of the American Continent. The opossum is characterized by having ten cutting-teeth above, eight below, and a prehensile tail, besides the peculiar characteristics of the order to which it belongs. (*See* MARSUPIATA.) The Virginian opossum (*Didelphis Virginiana*) is one of the best known examples of the tribe. The length of its head and body taken together is about 22 inches, and of its tail 15 inches; its fur is long and woolly, with very long hairs interspersed with that on the upper surface of the body; the general colour is dirty white, tinged with a slight yellowish hue; the legs are dusky brown; the eyes are surrounded with the same tint; hair on the upper parts of the body, of a deep brown, or blackish at the tip; the ears are large and naked, and are marked with white at the tip. This opossum, one of the largest species of the genus, inhabits North America, and is principally found in the States of Virginia, Louisiana, Mexico, and even Brazil and Peru. It is very destructive to poultry. It also feeds on roots and wild fruits, in the pursuit of which it is very active in climbing trees, from the branches of which it hangs suspended by its prehensile tail, swinging its body, which enables it to throw itself into the branches of neighbouring trees. When pursued and overtaken, the opossum will often feign itself dead, in order by this stratagem thus to escape its enemies. The flesh of the old animals is said to be good, its flavour somewhat resembling that of a sucking-pig; but the skin has a very fetid odour. Besides the Virginian opossum, there are the Crab-eating opossum, a large animal, native of Guiana and Brazil, and many others.

OPTICS, *op'-tiks* (from Gr. *optomai*, I see).—That branch of science which treats of the nature and properties of light; of the changes which it undergoes in its qualities or in its course when passing through bodies of different kinds and shapes, when reflected from their surfaces, or when passing near them; of the structure of the eye, and the laws of vision; and of the construction of those instruments in which light is the chief agent. (*See* LIGHT, and various headings.) From a bright object light emanates in all directions, and this light may be conceived to be made up of *rays*, or the smallest quantities of light which can proceed in any direction. An object, in order to be a source of light, must be of finite, though it may be of very small dimensions; thus, a bright point, which is a source of light, is considered as a geometrical point. Any substance which allows the transmission of light through it is called a *medium;* and light can proceed either through a medium or in vacuum. A *pencil* of rays is an assemblage of rays proceeding from a luminous point. In form, pencils are considered conical, and the axis of the cone is called the axis of the pencil. A conical pencil may consist either of convergent or of divergent rays; if the rays are proceeding from some source of light towards a point, the pencil is convergent, and divergent when the rays are proceeding from a luminous point. If rays are parallel, the pencil is neither convergent nor divergent. The direction of a ray of light proceeding in a uniform medium or in vacuum is rectilinear; but when it is incident on the surface of a medium, it is generally divided into three parts. One portion is reflected according to a regular law, and is called the *reflected ray*; another portion enters the medium according to a regular law, and forms the *transmitted* or *refracted ray*; a third portion is *scattered*, that is, reflected in all directions, without any regular law. It is the third portion which renders objects visible. There is also a certain portion of light besides the reflected, refracted, and scattered portions, which is *absorbed* by the medium. In the case of polished, metallic surfaces, the reflected ray is the only one which sensibly exists; and generally the relative intensities of the reflected and refracted rays vary with the circumstance of the incidence and also with the nature of the medium. The angle which a ray of light, falling upon a plane surface, makes with the line perpendicular to the surface, or the *normal*, is called the *angle of incidence*, and the angles which the reflected and the refracted rays respectively make with the same line are called the *angles of reflection and refraction*. When a ray is incident on a curved surface, it is reflected or refracted in the same manner as if it fell upon the plane which touches the surface at the point of incidence; and the angles of incidence, reflection and refraction, are those which the incident, reflected, and refracted ray, respectively, makes with the normal to this plane. (*See* REFLECTION and REFRACTION.) The names of *prisms* and *lenses* have been given to those transparent bodies which are most useful in optical experiments and in the construction of optical instruments. (*See* LAWS, PRISM SPECTRUM.)

OPTICAL ILLUSION.—A deception as to the real size, distance, shape, individuality, or colour of an object frequently experienced, depending sometimes on the angles formed by the incidence of rays of light on the eye, the refraction and reflection of rays, as in the case of mirage, and the retention of the figure of an object on the retina of the eye after it has been removed. This last illusion is experienced in the case of a very rapidly revolving point, which appear to form a circle. A familiar instance of optical illusion is that experienced by a person sitting in a railway train or easy-moving vehicle, when the objects passed appear to be moving. A disordered state of the organ of vision frequently produces illusions of a more permanent character.

OPUNTIA, *o-pun'-she-a* (from *Opuntis*, a city of the Locri, near which it flourished).—A genus of the natural order *Cactaceæ*. *O. vulgaris* is the prickly pear, a plant remarkable for its thick, fleshy, spiny stems. It flourishes in America and in the south of Europe, and has frequently been drawn in the foregrounds of pictures of Spanish and Italian scenery. Its fruit is edible, and has been imported into this country. The fruit of *O. Tuna* is of a carmine colour, and has been employed as a water-colour. *O. cochinellifera*, the Nopal plant, is cultivated in Mexico and other parts for the nourishment of the cochineal insect (*Coccus cacti*).

ORACHE, *o'-ratch*.—A genus of plants (*Atriplex*) of the natural order *Chenopodiaceæ*. There are many species growing in waste places and as weeds in gardens. Garden Orache (*A. hortensis*), known also as mountain spinach, and some other species, are used in some parts of Europe as a substitute for spinach.

ORANGE. (*See* CITRUS.)

ORANG-OUTANG. (*See* OURANG-OUTANG.)

ORB, ORBIT, *orb*, *or'-bit* (Lat., *orbis*).—Amongst ancient astronomers, orbs were vast crystal spheres, in which the heavenly bodies were supposed to be placed, and with which they revolved. Hence the term came to be applied to a sphere, as when the sun is called the "orb of day." In Astronomy, an *orbit* is the relative path in which a planet travels round the sun, or a satellite round its primary.

ORCHIDACEÆ, *or-kid-ai'-se-e* (from Lat., *orchis*).—The Orchis family, a natural order of *Monocotyledones*, sub-class *Petaloideæ*, known by its irregular flowers; by the peculiar form which one piece of the perianth (called the *labellum*, or *lip*) assumes in many cases, so as to cause the flower to resemble some insect, reptile, or bird; and by other striking peculiarities. The orchids (by some botanists named *Orchideæ*) are remarkable for the singularity, beauty, and fragrance of their flowers; and new species or varieties are highly prized by horticulturists. They are more or less abundantly distributed in nearly every region of the globe. There are about 460 genera and 3,000 species, but only about 40 are British species. Most of them are herbaceous perennials; but in hot climates some are shrubs and some are climbers, and some, especially in the hot, moist atmosphere of the South American forests, are epiphytes—that is, grow on the branches of trees, which are made beautiful by the splendid flowers. Vanilla is the most important commercial product of the order. (*See* VANILLA.) Orchids are carefully cultivated in this country, and many of the epiphytal kinds are grown in baskets placed on shelves, or suspended from the roofs of the orchid-houses, where they are cultivated.

ORCHIS.—A genus of the natural order *Orchidaceæ*. About eleven of the species are British, and some of them are abundant in summer, making the meadows gay with their bright flowers. The roots of several species, as those of *O. mascula* and *O. morio*, when dried, form European or indigenous *salep*. That prepared from the first-named species is said to be the best.

OREODAPHNE, *o-re-o-daf'-ne.*—A genus of trees belonging to the natural order *Lauraceæ*, and sometimes known as Mountain Laurel. The bark of *O. opifera*, a South American species, yields a volatile liniment which deposits camphor. A large tree, growing in the Mauritius (*O. cupularis*), yields the cinnamon of that island. Several species yield valuable timber: thus *O. exaltata* yields the *sweet-wood; O. fetens*, the *til* of the Canaries; and another species the *sirabelli* of Demerara. *O. bullata*, a native of Cape Colony, has a disagreeable odour, but the timber is hard and valuable.

ORES, *orez* (Sax., *ore*, ore).—Metals when found in combination with other substances, such as oxygen, sulphur, arsenic, &c., are called *ores*. They are usually found in veins of various thickness, and at various depths in the earth.

ORGAN.—In Physiology, any one of the parts or members of which a living body is composed, the union of the organs constituting an *organism*. Organic matter is that which forms the material of living things, either animal or vegetable; as inorganic matter is that which pertains to material having neither life nor parts. Some of the lower forms of life approach so nearly to the inorganic condition that it is difficult to discriminate between the two; but the most acute advocates of the development theory have now been able to trace a progress from one to the other.

ORGANIC AND INORGANIC CHEMISTRY.—The division of chemistry into organic and inorganic is more arbitrary than real; the line of demarcation between the two becomes every day more and more indefinite. The researches of modern chemists prove that the combination and decomposition of members of each division are regulated by precisely the same laws. The distinction between *organic* and *organized* bodies is often lost sight of by writers. It will, therefore, perhaps, be as well to define it. Organic compounds are those that have an amorphous or chrystalline structure and a definite composition, such as sugar, quinine, and acetic acid. They may, in certain cases, be obtained by the direct synthesis of their components from inorganic bodies. They are often spoken of as the proximate principles of plants and animals. Organized bodies are such as possess a rounded vesicular or fibrous structure, which, when once destroyed, cannot be restored, and form part of the system of the living animal or vegetable body. Starch, lignin, and cellulose may be adduced as examples. They cannot be formed by synthesis of their components, being the result of vital assimilation. Organic compounds may, however, be formed from them by substitution, such as pyroxylin, xyloidin, and others. (*See* CHEMISTRY.)

Organic Bases.—Organic bases are compounds containing nitrogen united with other elements having a more or less alkaline reaction, and capable of forming neutral salts with ammonia. They are generally divided into two classes—(1) bases obtained by artificial means, such as aniline, ethylamine, &c.; and (2) bases existing naturally in vegetable or animal substances, as, for instance, quinine, strychnine, morphine, kreatine, &c.

Organic Radicals.—An organic radical is a group of elements, whether or not isoluble, which may be transferred from one compound to another in exchange for one or more atoms of hydrogen or its representatives. They are divided into two principal classes—those like ethyl, tetryl, &c., which have electro-positive properties, and form bases; and those like acetyl, formyl, &c., which have electro-negative properties, and form acids. Liebig was the first to apply this theory to the explanation of the composition of the alcohols and organic acids; and although his views on the subject were at first vigorously combated, they afterwards received the strongest confirmation from the researches of innumerable experimenters. Of late years an important series of compounds, termed the organo-metallic radicals, has been discovered: cacodyl may be taken as the type of them. They are mostly formed by the union of a metal with one of the alcohol radicals, and act in combination precisely in a similar way to the metallic elements.

ORGANISTA, *or-gan-is'-ta.*—Small birds, allied to wrens, natives of South America, all remarkable for the sweetness of the song, which combines tenderness and exquisite modulation. One of the best known of these birds is the Peruvian Organista, the plumage of which is of a cinnamon colour, the head and neck being of a dark olive.

ORGANZINE, *or-gan'-zeen.* (*See* SILK MANUFACTURE.)

ORGEAT, *or'-zhat.*—An emulsion of blanched almonds, beaten into a paste and rubbed up with barley-water, powdered loaf sugar and orange flower water being added. An agreeable syrup is the result, useful also as a mild demulcent, especially in France, where it is known as *Sirop d' Orgeat.*

ORIGANUM, *o-rig'-a-num* (Gr., *oreiganon*, from *oros*, a mountain; *ganao*, I delight; because it grows on the sides of mountains.) (*See* MARJORAM.)

ORIOLE, *or'-e-ole* (*Icterus*).—A genus of birds (*Oriolus*) of the thrush family. There are many species, mostly natives of the warmer parts of Asia and Europe, only one species, however, being met with in the last-named continent. It is the Golden Oriole (*O. galbula*), common in Italy, and sometimes a visitant of England. The prevailing colour is yellow, and the adult males are noticeable for the brightness of their plumage. The name Oriole is commonly, but incorrectly, given to an American bird of the starling family. (*See* BALTIMORE BIRD.)

ORION, *o-ri'-on.*—The name given by the Alexandrian astronomer Ptolemy to one of the most conspicuous constellations in the heavens. The equinoctial passes nearly through its centre, and it is situated in the southern hemisphere with respect to the ecliptic. Four of the seven stars constituting the constellation are situated in the middle of it in a straight line. Two of these are of the first magnitude—namely, Betelguese or Beltegeux, in the right shoulder, and Rigel in the left foot, the latter a fine double star. In the middle of the square are three stars of the second magnitude, which form what is called the belt of Orion. Near the Sword scabbard, a remarkable nebula, and within the constellation are thousands of small stars, which are only visible by powerful telescopes.

ORNITHOLOGY, *or-ne-thol'-o-je* (Gr.,

ornis, a bird, and *logos*, a discourse).—That department of natural history which treats on all departments of science connected with the feathered race. (*See* BIRDS, and various headings.) Scarcely any attempt at a scientific classification of birds was made until about the middle of the 16th century, when Pierre Belon, a French naturalist, published "Historia Avium." Other observers and writers on the subject followed, correcting some of Belon's inaccuracies, and improving and extending his classification. Two Englishmen—Francis Willughby, who published "Ornithologia" in 1676, and John Ray, a contemporary—contributed greatly to a more extensive knowledge of the subject. Linnæus, the great Swedish naturalist, devoted great attention to ornithology, and his classification is generally accepted until Cuvier, in 1817, by the publication of his "Règne Animal" superseded it. Bewick, Audubon, Wilson, Yarrell, and many others, have contributed greatly to our knowledge of the appearance and habits of birds; and Owen, Gray, Huxley, and others, have investigated, with remarkable results, anatomical details.

ORNITHORYNCHUS. (*See* DUCKBILL.)

OROBANCHACEÆ, *o-ro-ban-kai'-se-e* (Gr., *orobos*, vetch; *ancho*, I strangle).—The Broom-rape family, a natural order of *Dicotyledones*, sub-class *Corolliflorœ*, consisting of fleshy herbs growing parasitically on the roots of other plants. The stems are scaly, without any true green leaves. There are about 120 known species, mostly natives of temperate climates, 11 being found in this country. (*See* EPIPHEGUS.)

OROBUS, *o'-ro-bus*.—A genus of plants of the natural order *Leguminosœ*, sub-order *Papilionaceœ*, allied to the Vetches. (*See* VETCH.) The species, mostly natives of Europe, are perennial and herbaceous, and are useful as food for cattle. The most common of the two species, which are natives of Britain, is *O. tuberosus*, the purple flowers of which are conspicuous on heaths, particularly in hilly districts. The tubers have a sweet taste, and, boiled or roasted, are used as food in the Highlands of Scotland and some European countries; and a fermented liquor is also sometimes made from them.

ORONTIACEÆ, OR ACORACEÆ, *o-ron-te-ai'-se-e, ak-o-rai'-se-e* (the Greek name of a plant now unknown to us, supposed to come from a river called Orontes, in Asia Minor).—The Orontium, or Sweet-flag order of *Monocotyledones*, in the sub-class *Petaloideœ*, herbaceous plants. The order is often regarded as a division of *Araceœ*. The plants included in it are found in cold, temperate, and tropical regions. (*See* ACORUS.)

ORRIS-ROOT, *or'-ris* (probably a corruption of *iris*).—The root of the *Iris florentina*, a white-flowering species of iris, which grows in southern Europe. It is well known in its dried state on account of its exhaling a pleasant odour, resembling that of sweet violets, and used as a perfume (and as tooth-powder, sometimes under the name "essence of violets"). Formerly it was much used in the preparation of medicines.

ORTHITE, *or'-thite* (Gr., *othos*, straight).—A variety of allanite, so called because it is always found in straight layers, generally in felspar. It is obtained in the mine of Finho, near Fahlun, in Sweden; consisting of cerium, protoxide of iron, protoxide of manganese, &c. It occurs in long brownish-black, acicular crystals.

ORTHIS, *or'-this*.—A genus of fossil brachiopodous mollusca, found in the Palæozoic rocks (*see* GEOLOGY), and including more than 100 species.

ORTHOCERAS, *or-thos'-e-ras* (Greek, straight horn).—A genus of cephalopodous mollusca, fossils of which are found abundantly in the lower Silurian, Trias, and other Palæozoic formations. They resemble the nautilus, "unrolled and straightened." Nearly 200 species have been described by geologists.

ORTHOPTERA, *or-thop'-te-ra*, (Gr., *orthos*, straight, and *pteron*, a wing.)—An order of insects which include all such as have their wings, when at rest, deposed in straight longitudinal folds. The orthoptera undergo a semi-metamorphosis, of which all the mutations are reduced to the growth and development of the elytra and wings, which are always visible in a rudimental state in the nymph; and, as both the nymph and the larva are otherwise exactly similar to the perfect insect, they walk and feed in the same manner. In some respects these insects resemble the Coleoptera. Some of the family are carnivorous or omnivorous, but the greater number feed on living plants. The species that belong to Europe produce but once a year, and this takes place at the end of summer, which period also marks their final transformation. The orthoptera are divided into two sub-families—(1) the *Cursoria*, which have their legs formed for running; (2.) the *Saltatoria*, which have their legs formed for jumping or leaping; as the grasshoppers and locusts.

ORTOLAN, *or'-to-lan* (Ital., *ortolano*).—An incessoral bird, *Emberiza hortulana*, a native of the north of Africa and the south of Europe, where as a delicacy it is much esteemed. The ortolan is about six inches in length. Its plumage is yellow on the throat and back, and the upper part of the body brown, based with black, the under part being of a reddish-bay colour. It is a bird of passage, and its migrations extend as far north as Lapland. The manner in which it is preserved is rather peculiar. In Cyprus, Italy, and the south of France, it is fattened with millet-seed and other grain, in a room from which the sun is excluded, but which is lighted up by lamps, which are kept constantly burning. By these means the birds become mere lumps of fat, when they are packed in casks, containing about four hundred, and preserved with spices and vinegar.

ORTYX, *or'-tix*. (*See* QUAIL.)

ORYX, *o-ri'-ks*.—A name given by ancient writers to an antelope, frequently represented on Egyptian monuments, and supposed to be identical with the Algazel (*Antilope Gazella*), a native of North Africa. (*See* ANTELOPE.)

ORYZA, *o-ri'-za*—In Botany, a genus of the natural order *Graminaceœ*. (*See* RICE.)

OSAGE ORANGE, *o-saj' or'-anj'*.—A tree (*Maclura aurantiaca*), of the natural order *Moraceœ*. It is a native of North America, and in some instances is 50 or 60 feet high. The wood is fine grained and so elastic that it is used by the Indians for making bows. The fruit resembles an orange, and gives a milky juice, but the flavour is disagreeable, although the fruit is not unwholesome.

OSCILLATION, *os-sil-lai'-shun* (Lat.,

oscillatio).—The vibration, or reciprocal ascent and descent of a pendulous body. The problem of oscillation, in its widest sense, includes most of those which occur in astronomy, optics, &c. To their average motions, the moon and planets add small oscillations about their mean places; the tides consist of oscillations of the ocean about the uniform spheroid, which, if it were not for the action of the heavenly bodies, would be carried round in the daily rotation of the earth; the phenomena of light are supposed to result from oscillations in an elastic ether; those of sound by oscillations in the air, &c. In general language, however, the problem of oscillation refers only to the purely theoretical part of the problem of the pendulum. (*See* PENDULUM.)

Centre of Oscillation.—That point in a vibrating body in which, if all the matter of the body were collected into it, the vibrations would be performed in the same time as before.

Axis of Oscillation.—A straight line passing through the point of suspension, parallel to the horizon.

OSCULATION, *os-kul-a'-shun* (Lat., *osculari*, to kiss).—In Mathematics, one curve is said to osculate another when it touches it at several points, and the number of points of contact mark the osculation as high or low.

OSIER, *o'-zher*.—A common name for those species of willow the thin branches of which are used for making baskets and other articles of wicker work. (*See* WILLOW.) The common osier (*Salix viminalis*) grows in moist situations in this country and other parts of Europe. The growth is low and bushy, and the branches long and slender. Other species, better adapted for finer work are *S. Forbyana*, *S. rubra*, *S. triandra* and *S. vitellina*, the last known as the golden willow. Osiers are extensively cultivated in England, Belgium, Holland, and France, succeeding best in rich soils.

OSMIUM, *oz'-me-um* (Gr., *osme*, odour).—One of the platinum group of metals, found in platinum residues. It differs from its congeners by its analogy with the arsenic and antimony group. There are five oxides of osmium known, of which the two highest act as acids. Osmic acid is volatile and very poisonous. Four chlorides are also formed. The metal itself is said to be the heaviest substance in nature.

OSMUNDA, *os-mun'-da*.—A genus of ferns distinguished by spore-cases in branched, stalked masses. The handsomest of all British ferns is the Osmunda Royal, or flowering fern (*O. regalis*), which in some instances attains a height of 11 feet, and is found in many parts of Europe and in North America. A starch-like substance is obtained from the root-stocks in some parts of Northern Europe.

OSPREY, *os'-præ* (Lat., *ossifraga*, the bone-breaker).—One of the most numerous species (*Pandion haliaëtus*) of the *Raptores*, or birds of prey, and one which is more widely diffused over the face of the globe than any other. It belongs to the *Falconidæ*, and generally dwells near the sea-shore, on account of its living nearly exclusively on fish. It catches its prey by sailing at a considerable altitude above the surface of the water, and when it perceives it, suddenly darting down and bearing it off in its claws with triumph. It measures about twenty-two inches in length. The beak is black, the eye blue, and the irides yellow; the top of the head and neck is white, shaded with brown; the whole upper surface of the body brown, with the ends of the primary feathers of the wings black; the under-surface of the body white, and the tail brown. It builds its nest on high trees or rocks, or about old ruins near the sea, or by the margins of lakes and rivers; and it lays three eggs, which are about two inches long, and are blotched and spotted over with reddish spots. As the osprey never preys on other birds, small birds frequently attach their nests to the osprey's nest, which is made of rotten sticks. In old times, the osprey, which is easily tamed, was trained to catch fish.

OSSEIN, *os'-sine*.—That substance in the tissue of the bones of animals which yields gluten, obtained by the prolonged action of hydrochloric acid, which dissolves the earthy matter of the bone.

OSSIFICATION, *os-se-fik-ai'-shun* (from Lat., *os*, bone; *facio*, I make).—The formation of bone. In the growth of the skeleton of man and the higher animals, this process goes on naturally, and it occurs in the reproduction of new bones after the destruction or loss of old ones. Bone is not a primary formation, but the result of the change effected in a cartilage or membrane by the deposit in it of earthy matter. Ossification also occurs as an unnatural or morbid process, and is observed in several tissues of the body. It occurs most frequently in the cartilages of the ribs, where the process is almost constantly going on in advancing years. Bone begins to form in the cartilages of the ribs after the fiftieth year; but in some cases it commences between the ages of thirty and forty. The cartilages of the windpipe are next to those of the ribs in their liability to become osseous. Ossification of the moveable joints never occurs. The disease called ossification of the heart is not an affection of the proper substance of that organ, but of its valves, in which earthy matter, composed of carbonate and phosphate of lime, is sometimes deposited, thus rendering them stiff and unyielding.

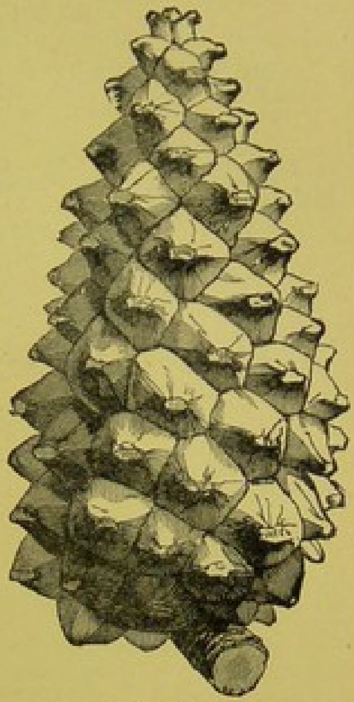
OSTEOLEPIS, *os-te-o-le'-pis* (Gr., bone-scale).—A genus of fossil ganoid fish found only in the old red sandstone, and seven species are described.

OSTEOLOGY, *os-te-ol'-o-je* (Gr., *osteon*, a bone, and *logos*, a discourse).—That part of the science of anatomy which treats of the bones. (*See* ANATOMY, BONE.)

OSTRACION, *os-tra'-she-un*.—A genus of the *Ostracionidæ*, a family of fishes of the order *Plectognathi*. In some of the species (all of which are known as Trunk-fish and Coffer-fish), the whole body is covered with six-sided bony scales. These fish are mostly found in the Indian and American Seas.

OSTRICH, *os'-tritsh* (Fr., *autruche*).—A genus of birds (*Struthio*) of the order *Grallatores*. The ostrich, the largest of known birds, distinguished not only for its great size, but for the beauty and value of its plumage, presents the following characteristics: "The true, or African ostrich is from seven to nine feet high, from the top of its head to the ground; the head, which is small, and the neck, which is long, are destitute of feathers, being clothed only with a few scattered hairs; the bill is straight and depressed. The feathers on the body are blackish; those on the wings and tail white, sometimes marked with black. The thighs are as bare as the head and

ORIOLE.



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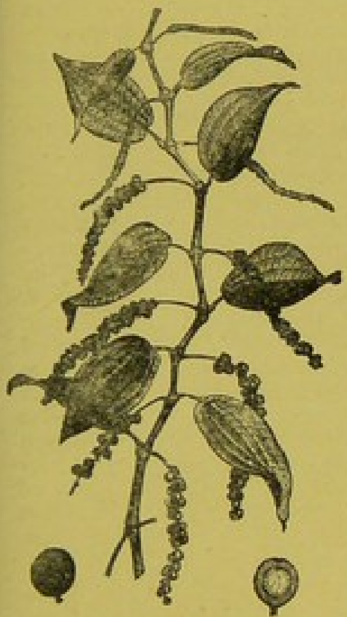

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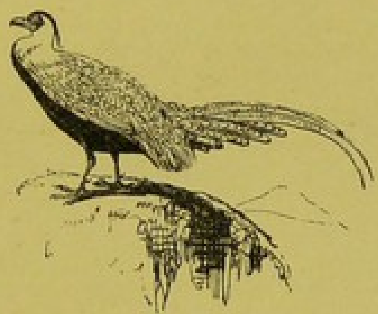
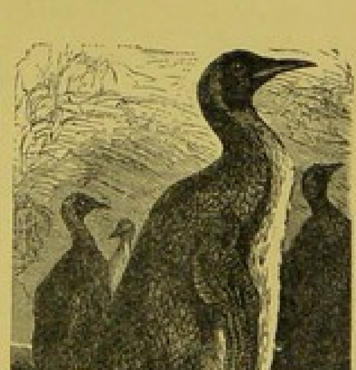


SILVER PHEASANT.

PARTRIDGE.

PECCARIES.

PUMA.



PENGUIN.

neck, and the legs hard and scaly. The most distinguishing features of the ostrich are the shortness of its wings, which are furnished with spurs, and the peculiar arrangement of their feathers, which utterly unfit the bird for flight. The bird appears to have been known from the earliest times, and there is a striking reference to it in the Book of Job (xxxix. 13-18). In some places in the Bible the word translated "owl" should be ostrich. The bird was forbidden in the Old Testament as an article of food, and was much prized by the gourmands of the Roman Empire. The African ostrich frequents the burning sands of that continent in large flocks. The female lays from ten to twelve eggs several times a year, in a hole in the sand, and broods over them only in the night, leaving them to be acted on by the sun during the hottest part of the day. As fashion has, for some time since, set a high value on certain feathers on the back or tail of the ostrich, it is frequently hunted, but is caught with difficulty, as by the aid of his wings he is able to run far more swiftly than the fleetest horse. The Arabians and Moors have two methods by which they are enabled to come up with them. In the one case, one of the hunting party pursues the bird, which always runs in a circuitous direction, as long as possible, and then the chase is taken up by another on a fresh horse, and so on until the bird is worn down. The other method is, for a hunter to cover himself with an ostrich-skin, and thus be enabled to approach the flock sufficiently near to surprise it. The ostrich, in a tame state, and probably also when wild, is apt to swallow with the greatest voracity such indigestible substances as iron, nails, stones, and bits of rag or leather; and is even, in one instance, said to have swallowed leaden bullets, hot from the mould without any apparent inconvenience. There is a species of ostrich found in South America, principally on the great plains in Buenos Ayres and the neighbouring States, which is inferior to the African ostrich in size, whilst its plumage, which is of a uniform gray colour, is almost valueless.

OSWEGO TEA, *os-we'-go*. (*See* MONARDA.)

OTALGIA, *ot-al'-je-a* (Gr., *ot*, the ear; *algos*, pain).—Neuralgia of the ear, producing agonizing pain, and commonly caused by decay of the teeth.

Otitus is an inflammation of the tympanic cavity of the ear, frequently associated with febrile affections. It frequently produces catarrhal inflammation of the lining membrane of the meatus, known at *Otorrhœa*, a painful affection accompanied by purulent discharges, which is, however, sometimes the result of other causes.

OTARY, *ot'-a-re*.—A genus (*Otaria*) of the *Phocidæ*, or seal family, but distinguished by possessing an external ear, and some peculiarities of the teeth. The fore-legs are placed further back than in the true seal, and the hind-legs resemble the fore-legs, another distinction. The largest species is the Sea Lion (*O. jubata*). (*See* SEA LION.) Another but smaller species is the Ursine Seal, or Sea Bear (*O. ursina*), of the North Pacific; and there are other species of the Pacific and Southern Oceans, one of the most valuable being the Fur-Bearing Seal (*O. Falklandica*), from which the soft sealskin so much in use is obtained. (*See* SEAL.)

OTOLITHUS, *o-tol'-i-thus*. (*See* SCIÆNEDÆ.)

OTTER, *ot'-ter* (Sax., *uter*).—A genus (*Lutra*) of carnivorous mammalia, in many particulars resembling weasels, martins, and polecats; but in other respects they differ from them. They have long, flexible bodies, low on the legs; their heads are compressed, and their tongues a little rough; but they differ chiefly from the animals just alluded to, from having their feet webbed and adapted for swimming, and their tails flattened horizontally. They are excellent swimmers, and feed almost entirely upon fish, which they frequently destroy wantonly when they do not need it for food. The otter is found in many countries widely distant from each other, and they differ in some particulars, according to the climate which they inhabit: the otters of India, for instance, having the hair very rough, whilst, in Kamtschatka, the covering of the otter is very soft and fine. But the coverings of otters of all countries have more resemblance to each other than those of land animals, being all grayish-brown, more or less dark on the upper part of the body, and generally white or whitish under the throat. The fur of all of them has the property of the feathers of diving birds, in not becoming wetted; and otters of all species reside in burrows, forming the entrance of their holes under water, and working upwards, making a small orifice for the admission of air in the midst of some neighbouring bush. The period of gestation is about nine weeks, and the litter consists of four or five. They make their appearance about April, and the mother drives them from the nest to shift for themselves about May. The European, or common otter (*L. vulgaris*), is about two feet in length to the insertion of the tail, which is 16 inches long; it is brown above, and whitish around the lips, on the cheeks, and beneath. It frequents rivers and lakes, and is also found in many places on the sea-shore; is a swift swimmer, and its movements in the water are very graceful. It feeds chiefly on fish, killing far more than it can possibly eat, and selecting the choicest morsels. If impelled by hunger, however, it eats snails, worms, and small animals of any kind. In former times, otter-hunting was a sport greatly in fashion in England, and is still occasionally practised. The otter, if procured young, may be tamed and taught to catch fish for its master; but the natural fierceness of the animal makes this a difficult task. Species of the otter are abundant in America (North and South), India, and South Africa. The Sea Otter, or Kalan (*L. marsus*), found in Behring's Straits and the adjacent seas, is as big again as the common otter, and is hunted for its fur, which obtains a large price.

OUNCE. (*See* JAGUAR.)

OURANG-OUTANG, *oo'-rang-oo'-tang* (Malay, wild man of the woods).—The name *Ourang* has been given to a species of monkey found in Africa, and commonly called the black ourang; but the ourang-outang (*Simia satyrus*) is a large ape, about five feet high, of a reddish-brown colour, a native of Sumatra and Borneo. Its native name in Borneo is "Mias," and it abounds in the low swampy grounds, covered with forests, of the south-western districts. These animals never jump or spring, and yet progress at a great pace as they swing from tree to tree. They sleep in a species of temporary nest made from day to day, of leafy branches laid across one another. They are not gregarious, but live in pairs with their young ones. Their food consists of fruits and berries, some of which are intensely bitter. The natives of the districts they frequent assert that the ourang-outang never attacks or is attacked by any animal except the crocodile, which attempts to seize him when he goes to the water's edge; whereupon the mias jumps upon the reptile's back, and after soundly thrashing it, forces open its jaws till he rips up its throat. Two allied species, the great Pongo, and a smaller ape (*S. morio*), are met with in Borneo.

OUZEL, OR OUSEL, *ou'-zel*.—The old English name for the blackbird, but sometimes applied to birds of the thrush family, as the ring-ouzel, the water-ouzel, and others.

OVAL, *o'-val* (Lat., *ovum*, an egg).—A name originally given, as its name implies, to any such form as the section of an egg presents—that is, round, but not circular. In mathematics, however, the term is applied to any curve, or isolated branch of a curve, which returns into itself.

OVARY, *o'-va-re* (from Lat., *ovum*, an egg). —That part of the *pistil*, or central organ of the flower, which contains the rudimentary seeds or ovules. These rudimentary seeds are attached to a projection on the walls of the ovary called the *placenta*.

In Anatomy.—In the female human being, the ovaries are oblong flattened bodies, situated on either side of the uterus, and in some respects analogous to the testes of the male. They contain numerous vesicles, which, when impregnated are carried into the uterus by the Fallopian tubes. A most painful disease is ovarian tumour, only relieved by a very delicate and difficult surgical operation.

OVEN-BIRD.—A genus (*Furnarius*) of the family *Certhiadæ*. The name is taken from the oven-like nests of clay and grass, divided into two portions by a partition. The birds, small and feeble in flight, are natives of Brazil and other parts of South America.

OVIPAROUS ANIMALS, *o-vip'-a-rus* (Lat., *ovum*, an egg; *pario*, I am delivered of). —Those which produce their young from eggs. The oviparous animals are divided into three classes—(1) the birds; (2) the reptiles; and (3) the fishes. Oviparous generation consists essentially in the circumstance that the animal is not attached through the medium of a placenta to the parietes of the uterus, or of the oviduct, but remains separated from it by its most external envelope. Those ovipara which breathe with lungs, have in the egg a vascular membrane, which appears to be subservient to respiration; it is connected with the bladder, and is analogous to the allantoid of the mammalia. It is neither found in fishes nor in frogs, which latter, when young, respire like fishes by means of branchiæ or gills. The eggs of fishes have a general resemblance to those birds, and consist of a vitellus and albumen with thin membranes; but in place of being furnished with a shell, they have a tough, or sometimes a horny covering; and some, as the torpedo and shark, are quadrangular in shape. The egg of the serpent is nearly the same with that of the fish, and is inclosed in a flexible membrane.

OVULE, *o'-vule* (from Lat., *ovum*, an egg). —A small, rounded, or oval, pulpy body, borne by the *placenta* of plants, and which, when impregnated, becomes a seed. It is either attached directly to the placenta, in which case it is said to be *sessile*, or indirectly by a stalk, called the *funiculus*, when it is described as *stalked*. (*See* PISTIL, PLACENTA.)

OWL, *owl* (Sax., *ula*).—A bird belonging to the order *Raptores* and the genus *Strigidæ*. In Great Britain, the species of owls are limited in numbers, amounting only to six or seven, and some of these even are of extreme rarity, and are only partial or periodical visitors. They fill during the night the same offices which are performed by the bolder-hunting falcons in the open day, and they serve to keep in check the increase of mice and other small mammalia which come out at night. For this purpose, the various organs of the owl are beautifully adapted. The vision is acute, although not suited to the light of noon; their ears are contrived to catch sound in the broadest way, and also possess a delicate perception; while their plumage is of the softest texture, falling lightly on the air, so as not to cause any obstruction, and the wings are constructed for light, buoyant, and noiseless flight. In addition to these advantages in the pursuit of their prey, another is found nearly as essential, and without which the others would be useless: the colour of the plumage exhibits a union of tints best suited for concealment, and renders the owl nearly invisible in the gloomy twilight or gray darkness of night. The tarsi and beak, although not showing any great strength, are finely formed for grasping; for, as in the *Scansores*, the external toe is reversible. In their habits, owls may generally be termed arboreal, the dark recesses of the forest, or wooded rocks, affording cover from the too strong light of the day. From these retreats they sally out at nightfall on predatory excursions, seldom returning without something for their nest. Their eggs are of a rounded form, and are always nearly pure white in colour. The geographical distribution of these birds is very extensive. The common white, barn, or screech owl, which may be taken as a type of the family, reaches the North-American continent. The long-eared owl is identical both in North America and Africa. The short-eared owl is not uncommon in the former continent, and it is also common to Asia, several specimens having been obtained from China. The family *Strigidæ* may be divided into three classes—(1) the Typical owls; (2) the Horned owls; and, lastly, (3) the Hawk owls. In the first section, the adaptation to nocturnal habits is complete; the members of it also possess a large external ear, and complete discs round the eyes. In the second, the horned owls have two feathery tufts on the head, resembling horns, and the external ear is smaller. In the third, the hawk owls have the external ear very small, and the feathery tufts and the discs round the eyes altogether wanting. The generic characters of the white or barn owl (*Strix flammia*), which may be taken typical of the family, may be thus briefly described: head smooth, not furnished with tufts; beak straight at the base, considerably curved at the point; cutting margin of the upper mandible nearly straight; under mandible notched; nostrils oval and oblique; facial disc large and complete; auditory opening large, and furnished with an operculum orbid; wings long and ample; legs long and slender, clothed with downy feathers to the juncture with the toes, claws long, curved, sharp, and grooved underneath. The white owl forms its habitation in churches, barns, old ruins, or holes in old trees. The head and upper parts of the body are a clear orange-colour, slightly marked with chestnut spots; the face is white; the wing-covers gray towards their tips; and the under surface of the body also white. It is about fourteen inches in length. Besides the barn or white owl, there are the tawny owl (*Syrnium stridula*), the eagle owl (*Bubo maximus*), the little horned owl (*Scops Aldrocandi*), the long-eared owl (*Otus vulgaris*), the snowy owl (*Surnia nyctea*) a very large bird, inhabiting northern regions; the hawk owl (*Surnia funerea*), and the little owl (*Noctua passerina*). The owls are very voracious birds; the large species feed on hares, fawns, and poultry, others on reptiles, birds, rats and mice, and some on insects.

OX, *oks* (Sax., *oxa*).—The male of the bovine genus of quadrupeds, *Bos taurus*, of the family *Bovidæ*, castrated and grown to its full size. In the earliest records which we possess, the ox is mentioned with respect. In Egypt it was long an object of worship; and when the Israelites were disposed to relapse into idolatry after their flight from Egypt, it was in the form of a golden calf (the name of a young ox) that they modelled the object of their impious rites. The history of the ox in this country commences with the account, given by the Roman invader Cæsar, of the state of the inhabitants when he invaded our island, from which we gather that they relied chiefly on the ox and the sheep for the supply of their wants. The common ox of the present time may be described as an animal which has smooth, hollow horns, a thick and heavy body, with a long tail terminated by a tuft of hair. There has been much dispute as to the origin of the British ox, some supposing that it has sprung from the Indian and European buffalo, and some treating them as arising from the *aurochs*, or wild cattle of Germany and Poland. There are several varieties of the ox in its wild state, which may be briefly described as—the *Bos Americanus*, or American bison, the characteristics of which are, short, black, rounded horns, with a great interval between their bases; a vast haunch, consisting of a fleshy substance much elevated; thick and strong fore-parts of the body; hinder-parts slender and weak. The *Bos bibulcus*, or buffalo, properly so called, originally a native of India, from whence it was introduced into Egypt, Greece, and Italy. The *Bos gavæus*, or Hindoo bull, with a dull and heavy aspect, but in reality almost equalling the buffalo in activity and strength. The *Bos Caffer*, or Cape buffalo, distinguished for the size and extent of its horns, its great strength and ferocity. The *Musk Ox* is a singular animal, clothed with full, long, matted wool, or dense fur, and found in the high latitudes of North America and the lands of the Esquimaux. Of the ancient race of British cattle, some remains are yet to be found in several parts of England, preserved in pastures adjoining the estates of noblemen. The Chillingham herd of wild cattle is well-known. These animals are characterized by creamy-white skins, black muzzles, and white horns with black tips bending upwards. Almost every part of the ox is of use to mankind. Boxes, combs, knife-handles, and drinking-vessels are made of the horns; glue is made of the cartilages, gristles, and the finer pieces of cuttings and parings of the hides. The skin of the young ox is made into vellum; the hair is valuable in various manufactures, and the suet, fat, and tallow for candles. The value of its flesh as food need scarcely be mentioned.

Breeds of Oxen.—The modern breeds of oxen in Great Britain are remarkable for their numerous varieties, caused by the almost endless crossings of one breed with another. One of the principal varieties is the North Devon, distinguished for the activity of its movements, its docility, and powers of labour. The Hereford are larger than the Devon, and fatten to a much greater weight. The Sussex breed has all the activity of the Devon and the strength of the Hereford, the propensity to fatten, and the fine-grained flesh of both. The Welsh, stunted in growth, from the poverty of the pastures, thrive where others starve, and rapidly outstrip most others when they have plenty of good pasture. The Scotch oxen have many varieties: the principal being the West Highlanders, or Kyloes, as they are called; the Argyleshire breed; the cattle of the Shetland Islands, which are dwarfish, ill-shaped, and covered with hair. Fifeshire possesses a breed peculiar to itself, of a very superior description; and the Galloway polled cattle are a fine and valuable breed, from which is descended the celebrated dun cow of Suffolk. Of Irish cattle there are two breeds—the middle-horns and the long-horns: the former being the original breed, tenanting the forests and most mountainous districts; whilst the latter are descended from an old Lancashire or Yorkshire breed.

OXALIC ACID, *oks-al'-ik* (Gr., *oxus*, acid). —A very powerful organic acid, existing ready-formed in the leaves of the wood-sorrel, in the leaf-stalks of the common garden rhubarb, and in many other plants having an acid taste. It is also found in combination with lime, in crystals, and in the juices of many vegetables.

OXALIDACEÆ, *oks-a-lid-ai'-se-e.* — The Wood-sorrel family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*. The plants of this order are generally distributed throughout both the hot and the temperate regions of the globe; the shrubby species, however, are almost confined to the tropics. There are 9 genera and 328 species. They are chiefly remarkable for their acid juice, containing binoxalate of potash.

OXALIS, *oks'-a-lis.*—A genus of the natural order *Oxalidaceæ*. The common wood-sorrel, *O. acetosella*, which abounds in our woods, is a well-known species. It has ternate leaves, and is considered by many to be the true shamrock, as its leaves open about St. Patrick's day. When infused in milk or water, it forms a pleasant refrigerant drink in fever. The leaves, taken as salad, are antiscorbutic. The species *O. crenata*, called the Arracacha, and several others, have edible tubers, which are used as substitutes for potatoes in some districts. *O. anthelmintica*, the Mitchamitcho of Abyssinia, has very acrid tubers, which are employed for their anthelmintic properties, being frequently preferred to kousso.

OXALURIA, *ox-a-lu'-ri-a.*—A morbid condition of the body (known also as the oxalic acid diathesis), one of the most prominent symptoms of which is the occurrence of crystals of oxalate of lime in the urine. Where this diseased condition exists, it is generally accompanied by dyspepsia, hypochondria, eruptions of the skin, and neuralgia. The oxalic acid which produces this morbid state, is a product of the disintegration of the tissues.

OXFORD CLAY. In Geology, the principal bed of the middle oolite series, sometimes 600 feet in thickness. It is composed of stiff dark blue or blackish clay, and extends across England from the coast of Dorsetshire to Lincolnshire.

and Yorkshire. The fossils of shells are remarkably well preserved, some retaining their iridescence.

OXIDATION, *ox-i-dai'-shun.*—The union of any body with oxygen, so becoming oxidized. The resulting compound is termed an *oxide.* Metallic oxides, important compounds of the metals, in many cases occur naturally as abundant and valuable ones, and are divided into three classes—basic, saline, and acid.

OXLEYA, *ox-lay'-a.*—A genus of trees of the natural order *Cedrelaceæ.* One of the most valuable species, *O. xanthoxyla*, or yellow wood, a native of Eastern Australia, attains a height of 100 feet, and is valuable for its timber.

OXYCOCCUS, *ok-se-kok'-kus.*—In Botany, the Cranberry, a genus of the natural order *Vacciniaceæ. O. palustris* (sometimes termed *Vaccinium Oxycoccus*) produces the British cranberries, used for making tarts, jams, &c. *O. macrocarpa* yields the American cranberries, which are now largely imported into this country for the use of pastrycooks.

OXYGEN, *oks'-e-gen* (Gr., *oxus*, acid; and *gennao*, I generate).—Oxygen is the most abundant of the elements. It forms $\frac{8}{9}$ of water, $\frac{1}{4}$ of air, and about $\frac{1}{2}$ of silica, chalk, and alumina, the three chief constituents of the earth's surface. It is also the most important element, being essential to the support of animal life. It is met with in nature in mechanical combination with nitrogen, as the atmosphere which surrounds our globe. It is also given off by growing plants, under the influence of direct sunlight. It possesses strong chemical properties, uniting with all the elements, except fluorine, in a large number of proportions. It possesses slight magnetic properties, of all known substances exerts the smallest refracting power on rays of light, and supports combustion in an eminent degree. It is tasteless, colourless, inodorous, and has hitherto resisted all efforts at compression; and is sparingly soluble in water, being only absorbed in the proportion 3 per cent. The atomic weight is 16, symbol O, specific gravity 1·1056. It was discovered in 1774 by Priestley, who obtained it by the action of heat on red oxide of mercury. Oxygen was so named by Lavoisier from the supposition that it was the acidifying principle, and it was thought by him to be essential to the constitution of an acid. Davy's researches on chlorine disprove this theory, by showing that hydrochloric acid contained no oxygen. (The description of the various compounds of oxygen will be found under the heads of the elements with which it is united.)

OXYURIS VERNICULARIS, *oks-yu'-ris ver-nik'-u-lar-is.* (*See* ASCARIS.)

OYSTER, *ois'-ter* (Gr., *ostreon*, from *osteon*, a bone).—The large and important family of *Ostreadæ* (lamellibranchiate molluscs) includes shells of very various outline and sculpture, constructed by animals varying in several particulars, but having so many important characters in common, that in natural history they are considered to belong to the same group. The genus consists of more than 130 species, of which the best-known is the edible oyster (*Ostrea edulis*). The oysters were known to, and valued by, the ancients. Oysters are found in various places on the coast of France: as at the mouth of the Seine; on the coast of Caen, in Normandy; and at Cancale, on the coast of Brittany. Spain has oysters, which are of a red or russet colour. The Dutch have oyster-beds on the coast of Zealand; but their most famous oysters are those which they transport every year from the English coast, and preserve in pits at Petten, in North Holland. The northern part of Germany is supplied with oysters from exceedingly rich banks on the coasts of Holstein and in the neighbourhood of Jutland. Norway and Sweden have oyster-beds on various parts of their coasts. Italy has oysters of various qualities, those found at Ancona being of large size, but not well tasted; whilst those found in prodigious quantities near Tarentum, in the sea called Mare Piccolo, are excellent. In the West Indies, oysters are tolerably abundant, and are frequently found growing on the boughs of mangrove-trees, which, in such places as the heads of bays or harbours, are frequently under water. Lately, oysters from the north-eastern coasts of North America have been introduced into this country. Oysters are of different colours in different places: those of Spain being of a red colour; those of Illyria, brown; and those of the Red Sea, of the colour of the rainbow. The only coloured oysters, however, which are in repute, are green oysters; such as those of the Bay of Biscay, Dieppe, Cancale, and the Marennes, which are in such esteem that other oysters are frequently made to assume their hue by artificial means: namely, by placing them in pits in the salt-marshes, and covering them with salt-water to the depth of about a foot and a half. These pits, from some quality in the soil co-operating with the heat of the sun, will become green, and communicate their colour to the oysters that are put into them in four or five days, though they are commonly allowed to remain there six weeks or two months, by which time they will be of a dark green.

Oyster Worm.—Oysters are subject to several kinds of parasites, the most remarkable of which is the oyster-worm, which presents the appearance, on the opening of the oyster subject to it, of a sort of shining clammy moisture, like a star of a bluish colour, but which, when drawn out, proves to be a worm nearly half an inch long.

OYSTER CATCHER.—A genus of birds (*Hæmatopus*), of the family *Charadriadæ.* The only European species (*H. ostralegus*), found also in the north of Asia and the north of Africa, is about 16 inches in length, with contrasted white and black colours, which have given it the popular name of Sea Pie. It has a remarkable long, straight bill, and legs of moderate length. It feeds on molluscs, crustaceans, and small fishes. The American species is larger than the European.

OZÆNA, *o-ze'-na.*—A discharge of purulent matter from the nostrils, a symptom of disease.

OZOKERIT, *o-zo'-ke-rit.*—A mineral hydrocarbon, found in Roumania. A substance suitable for making candles is distilled from it.

OZONE, *o'-zone* (Gr., *ozein*, a scent).—A peculiar modification of oxygen, supposed to be that gas in a permanently negative state, and exhibiting very energetic properties as compared with the gas in its ordinary condition. It bleaches the vegetable colours, converting indigo, for instance, into colourless isatin. It oxidates black sulphide of lead into the neutral sulphate, and converts moist iron, copper, and even silver fil ings, into their respective oxides. There are several methods of forming it; one of the easiest consisting in transmitting a succession of electric sparks through a tube containing pure, dry oxygen. Although formed in minute traces only, the characteristic smell of this peculiar body is soon perceived. It may be detected, chemically, by immersing in a vessel, containing even the smallest trace of it, a piece of paper covered with moistened starch and iodide of potassium. The ozone immediately displaces the iodide, which unites with the starch, giving rise to a blue colour. A temperature a little below 212° is sufficient to destroy the active properties of ozone. It appears to act most beneficially as a disinfectant in the economy of the world; it having been proved that epidemic diseases, such as cholera, fevers, &c., are always accompanied by a decrease, or entire absence, of this agent from the atmosphere.

P.

PACA, *pa'-ka.*—A genus (*Coelogenys*) of rodent quadrupeds, natives of South America and the West Indies. They are allied to the Agouti (*see* that heading); but the cheek-bones are enormously developed, and the cheek-pouches are capable of great distention. It is about two feet long, generally of a dark brown colour, with white spots and white throat and belly. It feeds on vegetable substances, and the flesh is considered a delicacy.

PACHYDERMATA, *pak-e-der'-ma-ta* (Gr., *pachus*, thick, and *derma*, skin).—An order of quadrupeds, mammalians, such as the elephant, hippopotamus, &c., distinguished from others by the thickness of their skins. The *pachydermata* are subdivided into three genera,—viz. (1), the *Proboscidea*, which enumerates such as have a long proboscis, and five toes on each foot, enveloped in a thick horny skin: the elephant may be mentioned as a type of this subdivision; (2), the *Pachydermata ordinaria*, in which the feet may have four, three, or two separate toes: as, for instance, the hippopotamus, rhinoceros, tapir, &c,; and (3), lastly, the *Solidungula*, which possess only one toe and a single hoof to each foot, as in the horse and other *Equidæ*.

PACHYMA, *pak-i'-ma.*—A genus of *Fungi*. The species *P. Cocos* is highly esteemed as a food and medicine by the Chinese, and by the Indians of North America. It is called Tuckahoe, or Indian bread, in America.

PACOURY-UVA, *pa-koo'-re-u'-va.* — A Brazilian fruit of delicious flavour, the product of the *Platonia insignis*, a tree of the natural order *Clusiaceæ*.

PÆONY, *pe'-o-ne* (Gr., *Paion*, one of the names of Apollo, as the god of medicine).—A genus of plants (*Pæonia*) of the natural order *Ranunculaceæ*, natives of Europe, Asia, and North-Western America. They are large herbaceous, or half-shrubby perennials. Some of the species are cultivated in our gardens on account of the beauty of their carmine-coloured or white flowers. The Chinese Pæony, or Moutan, sometimes attains a height of 12 feet, and grows as an ornamental plant in the south of the continent of Europe, and in the southern parts of England and Ireland. The roots of the common pæony (*P. officinalis*) was held by the ancient to be a valuable antispasmodic. The black seeds were in old times made into necklaces, and worn on the necks of children to ease the pain of teething.

PAGURUS, *pa-gu'-rus.* (*See* HERMIT CRAB.)

PAIN.—A sensation which requires little explanation, as all persons have had more or less practical experience of it. It is an affection of the nervous system, arising generally either from inflammation or from debility. It is not always felt in that part of the body where the cause of it exists, and differs considerably in character, being dull or acute, intermittent or continued. Some persons are more sensitive than others to pain, according to the amount of activity of the nervous system; and it may be assumed that the less complex the nervous organization of an animal, the less acutely is pain felt.

PAINTERS' COLIC. (*See* COLIC.)

PALÆONTOLOGY, *pa-le-on-tol'-o-je* (Gr., *palaios*, ancient; *onta*, beings; *logos*, a discourse).—That branch of geological science which treats of fossil organic remains. Much of the light that has been thrown of late years on the formation and constitution of the globe, is due to the discoveries and investigations of palæontology. The geologist, by its means, is able to trace the successive orders of animals and plants which have inhabited the earth at different periods of its existence. All fossiliferous systems may be viewed in two great aspects—either as regards their mere mineral and physical relations, or as regards the plants and animals found as fossils in their strata. The former constitutes the lithology and the latter the palæontology of a formation. (*See* GEOLOGY.) Professor Huxley tells us that nearly 40,000 species of animals and plants have been made known by palæontological research.

Palæaster, *pa-le-as'-ter.*—A genus of fossil starfish peculiar to the Silurian period. About six species have been recognized and described.

Palæoniscus, *pa-le-o-nis'-kus.*—A genus of fossil ganoid fishes, 28 species of which, found in the Carboniferous and Permian strata, are described by geological writers.

Palæopyge, *pa-le-o-pi'-je.*—The name given to a supposed genus of fossil crustacea, which may have been associated with the earliest forms of organic life on the globe. No fossil remains have been discovered, and the existence of such a creature is only surmised from an impression in the surface of a geological bed of the Cambrian age.

Palæosaurus, *pa-le-o-saw'-rus.*—A genus of large fossil reptiles of the lizard kind, found only in beds of the Permian period.

Palæotherium, *pa-le-o-the'-re-um.*—A genus of pachydermatous mammalia, resembling the existing tapir in general appearance. Some of the fossil remains found in the Eocene beds of England and the continent of Europe indicate an animal about the size of a horse, but often are much smaller.

Palæozoic, *pa-le-o-zo'-ik.* (*See* GEOLOGY.)

PALAPTERYX, *pa-lap'-te-rix.*—A fossil

bird of New Zealand, resembling in some respects the Dinornis and the existing Apteryx. (*See* APTERYX and DINORNIS.) Two species are known.

PALATE, *pal'-ait* (Lat., *palatum*).—The roof or upper part of the mouth. In man it is composed of two parts—the hard palate, which forms an arch in the interior part of the mouth; and the soft palate, which lies in the posterior part of the mouth, and consists of a membraneous curtain of muscular and cellular tissue, from the middle of which hangs the uvula.

PALAY, *pai'-lai.*—A climbing plant (*Cryptostegia grandiflora*), of the natural order *Asclepiadaceæ*, common in many parts of India. The fibre is strong and white, and can be spun into fine yarn, and the milky juice contains caoutchouc.

PALEA, *pa'-le-a* (Lat., chaff).—A botanical term for the bracts of grasses and of the flowers of many of the *Compositæ*.

PALINGENESIÆ, *pal-in-je-ne'-se-a* (Gr., born again).—In Natural Science, the term has been applied to gealogical changes and the transformations of insects.

PALISANDER WOOD, *pal'-i-san-der.* (*See* ROSEWOOD.)

PALIURUS, *pal-i-u'-rus.*—A genus of trees and shrubs of the natural order *Rhamnaceæ*. One species (*P. aculeatus*) is popularly known as Christ's thorn, from a tradition that the crown of thorns was made from it. It is a deciduous shrub, with slender branches and ovate leaves, each of which has two sharp spines at the base. The branches are found to be well adapted for the formation of hedges, and are used for that purpose in Italy and other parts of the south of Europe. The plant is a native of the coasts of the Mediterranean and many parts of Asia. The fruit is flat and thin, attached by the centre to the footstalk. In some Eastern countries the seeds are used medicinally.

PALLADIUM. *pal-la'-de-um.*—In Chemistry, one of the rare metals found in the ores of platinum in the proportion of 1 to ½ per cent, and also more abundantly is the native alloy which it forms with gold in some of the Brazilian mines. It is a white, hard metal, having a specific gravity of 11·8. It is very infusible, but melts readily in Deville's oxyhydrogen furnace. Its rarity has prevented its application to numerous useful purposes. It forms three oxides, and several other compounds at present little known. It has a stronger affinity for cyanogen than any other metal, and forms a series of double cyanides. It readily combines with gold, forming a peculiarly white alloy, even when present in small proportions. It was discovered by Wollaston in 1803, and was named by him from the planet Palias, discovered the year before.

PALLAS, *pal'-las.*—One of the asteroids or smaller planets discovered by Olbers, at Bremen, on the 28th of March, 1802. The size of Pallas has not been measured with accuracy, but it is known to be exceedingly small.

PALLIOBRANCHIATA, *pal-le-o-bran-ki-a'-ta.* (*See* BRANCHIOPODIA.)

PALMS. (*See* PALMACEÆ.)

PALM OIL. (*See* OIL.)

PALMA CHRISTI. (*See* CASTOR OIL PLANT.)

PALMACEÆ, *pal-mai'-se-e* (Lat., *palma*, palm).—The Palm family, a natural order of *Monocotyledones*, sub-class *Petaloideæ*. They are generally tall trees, often attaining a great height without a branch, and the leaves, which are of great size, form a very handsome crown. Most of the plants of this order are tropical. There are at least 400 species. (*See* COCOA PALM, DOOM PALM, OIL PALM, RATTAN, and other headings.) Palms rank next to grasses as regards their useful dietetical and economical applications. They yield sugar, starch, oil, wax, wine, resin, astringent matters, and edible fruits and seeds. Their leaves are used for thatching houses, as materials for writing upon, for making hats, matting, &c. Their wood is applied to many useful purposes. The fibres of their petioles and fruits supply the raw materials for cordage, cloth, and various textile fabrics. Lastly, the hard albumen of their seeds is made use of in many ways.

PALMELLACEÆ, *pal-me-la-se'-a.*—A family of *Algæ* of the order *Conferraceæ*. Their organization is almost the lowest of the vegetable kingdom. Some resemble powder, or Red Snow; others a slimy film, as Gory Dew, and some have the appearance of a frond.

PALMYRA PALM, *pal mi'-ra.*—A species of palm (*Borassus flabelliformis*), a native of Hindostan and the north of Ceylon, where it is very abundant. It averages about 50 feet in height, and has a crown of fan-shaped leaves about four feet long, attached to a stalk of about the same length. The fruit yields a fine oil, and is also cooked as an article of diet, and the young plants are in favour as a culinary vegetable. Palm-wine, sugar, and the intoxicating arrack of India are supplied by the tree, and the wood is of value for building purposes. Indeed, this fine palm furnishes nearly everything that a large native population requires. The timber of other palms is also known in commerce as Palmyra wood.

PALO BLANCO, *pai'-lo blan'-ka.*—A large tree (*Flotovia dicanthoides*), belong to the order *Compositæ*, a native of Chili. The wood, which is white, is useful for many purposes, and wears well.

PALO DE VACO. (*See* BROSMIUM.)

PALOLO, *pal o'-lo.*—An annelid (*Palolo viridis*), found in great numbers in the sea near the coral reefs of the Pacific. It is about three inches long, and very slender, the body being divided into joints, with tufts of gills on each side. The natives of the South Sea Islands consider them to be great delicacies, when wrapped in the leaves of the bread-fruit tree and baked.

PALPITATION, *pal-pi-tai'-shun.* — The term applied to abnormally strong palpitation of the heart, which produce recurring paroxysm of a very unpleasant and frequently painful character. Mental or physical excitement will produce palpitation, causing hurried or difficult respiration, and the heart appears to be rising towards the throat, an effect which originated the common phrase descriptive of the emotion of surprise, "My heart is in my mouth." In some cases, the frequent occurrence of palpitation indicates the presence of heart disease; but more frequently it is only a functional derangement. Young persons, especially females, are most liable to it, and it is encouraged by the excessive use of tea, coffee, tobacco, and spirits.

PALSY. (*See* PARALYSIS.)

PAMPAS GRASS, *pam'-pas.*—A tall, hardy grass (*Gynerium argenteum*) with flowering stems, about 12 feet high, and long silvery flowers. It grows freely on the *pampas*, or plains of South America, especially in Brazil. An allied species (*G. saccharoides*) yields sugar.

PANAX, *pan'-aks* (Gr., *pan*, all; *akos*, remedy).—A genus of the natural order *Araliaceæ*. *P. Schinseng* produces the root called Asiatic *ginseng*, which is so highly prized by the Chinese as a stimulant and aphrodisiac, that they will sometimes give for it its weight in gold. It is not much valued in Europe. The root of *P. quinquefolium*, a North American species, has similar properties.

PANCREAS, *pan'-kre-as* (Gr., *pan*, all, and *kreas*, flesh).—A single glandular organ situated transversely across the upper part of the abdomen, at the posterior part of the epigastric region, about on a level with the last dorsal vertebra. It is of an irregular elongated form, from six to eight inches in length, an inch and a half in breadth, and from half an inch to an inch thick. The right extremity or head is curved upon itself from above downwards, and is embraced by the concavity of the duodenum. Its body tapers towards its left extremity, where it forms a tail terminating at the spleen. The pancreatic duct extends from left to right through the substance of the pancreas, giving off numerous branches, and terminating in the common choledic duct, which conducts its secretions to the duodenum. In structure, the pancreas closely resembles the salivary glands, but it is looser and softer in texture; and the fluid secreted is almost identical with saliva. Its object is believed to be to reduce fatty matters to the state of an emulsion, and thereby promote their absorption by the lacteals. The amount daily secreted by man is from five to seven ounces, and it is most abundant at the commencement of digestion. Its importance is evident from the fact that it is found in all vertebrates, whether carnivorous or herbivorous. The pancreas of the calf and the lamb is known as sweetbread, and is a very delicate article of food.

PANDA, *pan'-da.*—A quadruped (*Ailurus fulgens*) of the *Ursidæ*. Only one species is known, and that is a native of the Himalaya region. It is about the size of a large cat, and has a covering of long, soft, chestnut-coloured hair over thick wool. It lives mostly in trees, feeding on birds, small quadrupeds, and insects.

PANDANACEÆ, *pan-dan-ai'-se-e.*—The Screw-pine family, a natural order of *Monocotyledones*, sub-class *Petaloideæ*, consisting of tropical palm-like trees and shrubs. There are nearly 100 known species. None possess any very active properties. The genus *Pandanus* has edible seeds. The juice which flows from the wounded spadices of *Nissa*, when fermented, furnishes a kind of wine. The fruit of *Nissa fruticans* is the *atap* of India. The unexpanded leaves of *Carludovica palmata* furnish the material employed in the manufacture of Panama hats.

PANGIACEÆ, *pan-je-ai'-se-e.*—A small natural order of arborescent unisexual plants, nearly allied to *Papayaceæ*, but differing principally in being polypetalous, and in the fertile flowers having as many scales as there are petals. There are two genera and four species, natives exclusively of the hotter parts of India. They are all more or less poisonous; but the seeds of one species, *Pangium edule*, after being boiled and soaked, are used for flavouring curry.

PANGOLIN, *pan'-go-lin.*—The name of the short-tailed Manis, but sometimes extended to the whole family. (*See* MANIS.)

PANICLE, *pan'-i-kl.*—In Botany, a mode of inflorescence in which the floral axis is frequently subdivided. Most of the grasses and the lilac exhibit this form.

PANICUM, *pan'-e-kum.*—In Botany, a genus of grasses, including several useful species. *P. miliaceum* yields the grain called Indian millet (*see* MILLET), the *warree*, and *kadikane* of the East. *P. spectabile*, a Brazilian species, attains the height of six feet or more, and is an excellent fodder grass. It is commonly known as Angola-grass. *P. jumentorum* is another fodder-plant, known as Guinea-grass. *P. pilosum* yields the grain called *bhadlee* in India. The grain of *P. frumentaceum* is used in the Deccan under the name of *shamoola*.

PANTHER, *pan'-ther* (Gr., *panther*).—A large quadruped, *Felis Pardus*, measuring about six feet and a half from nose to tail, and belonging to the order *Felidæ*, and now generally considered to be a variety of the leopard. It is principally found in Africa, although it is also scattered through the southern parts of Asia and the Indian Archipelago. It is fawn-coloured above and white beneath, with six or seven rows of black spots on its flanks. In some, the ground of the fur is black, with spots of a deeper colour; but they are not a distinct species. The tail is about the length of the body deprived of the head. Panthers used to be exhibited in Rome in large numbers on the occasion of the celebration of any triumphal procession; and hence it appears that they were far more numerous in the days of antiquity than in the present time. Pompey is said to have exhibited 510, while Augustus Cæsar even eclipsed the latter, by exhibiting no less a number than 520. There is a species termed *panther* in America, which, however, does not belong to the family. (*See* JAGUAR.)

PAPAVERACEÆ, *pa-pav-e-rai'-se-e.*—The Poppy family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*. The plants of this order are in almost all cases characterized by well-marked narcotic properties; nearly two-thirds of them are natives of Europe, and are mostly annuals. There are 18 genera and 130 species. Many genera are commonly cultivated in our gardens, as *Papaver*, *Argemone*, *Rœmeria*, *Platystemon*, and *Eschscholtzia*. The latter is remarkable for its enlarged hollow thalamus, from which the calyx separates by transverse dehiscence in the form of a conical cap, resembling the extinguisher of a candle. (*See* POPPY.)

PAPAYACEÆ, *pa-pa-ai'-se-e.*—The Papaw family, a natural order of *Dicotyledones*, sub-class *Calicifloræ*. They are trees or shrubs, sometimes with an acrid milky juice. There are 30 species, natives of South America and of the warmer parts of the Old World. (*See* PAPAW.)

PAPAW, *pa-paw'.*—A tree (*Carica Papaya*) of the natural order *Papayaceæ*. It attains an average height of 25 feet, and the stem, like that of the palm, is branchless, but there is a crown of leaves, each about 2 feet long. The fruit, of a green colour, resembling a melon in appearance, is eaten either raw or boiled, and the seeds have a pungent flavour; and both seeds and fruit have medicinal properties. A peculiarity of the tree is that the juice of the fruit and the sap make the toughest meat tender in a very short time; and even if joints of meat or poultry are hung among the branches of the tree, and so exposed to its exhalation, the quality of tenderness is imparted. The tree grows rapidly, and bears fruit abundantly throughout the year.

PAPER NAUTILUS. (*See* ARGONAUT.)

PAPILIONACEÆ, *pa-pil-yo-nai'-se-e* (Lat., *papilio*, a butterfly, from the resemblance which the flowers bear to this insect).—A sub-order of the large and important natural order LEGUMINOSÆ (which *see*). Nearly 5,000 species are known.

PAPILIONIDÆ, *pa-pil-yo-ni'-de* (Lat., *papilio*, a butterfly).—A genus and family of lepidopterous insects, belonging to the section of the class termed *Diurna*. (*See* BUTTERFLY.)

PAPILLÆ, *pa-pil'-le*.—Minute conical processes, vascular and nervous, projecting from the surface of the true skin into the epidermis. They are connected with the senses of touch and taste.

PAPPUS, *pap'-pus* (Gr., *pappos*, old man, or grandfather; hence a substance resembling gray hairs).—A term applied in Botany to the calyx of *Compositæ*. It generally exists in the rudimentary stage of a cap or apparently membraneous coronet. In some plants it is formed of slender hairs. (*See* AIGRET.)

PAPULAR DISEASES, *pap'-u-lar*.—A term applied to the appearance on the skin of *papulæ*, or pimples.

PAPYRUS, *pa-pi'-rus* (Lat.).—A genus of the natural order *Cyperaceæ*, the Sedges. *P. antiquorum*, the bulrush of the Nile, is celebrated on account of the soft cellular substance in the interior of its stems, having been in common use by the ancients for making a kind of paper. The uses of the papyrus were not confined to the making of paper alone, but it was also used for making sail-cloth, cordage, and wearing apparel. At the present day it is still used for some of these purposes. In Abyssinia, boats are also made by weaving the stems closely together, and covering them with a sort of resinous matter. The roots are also employed for fuel. Its most ancient and important use, however, was for the manufacture of paper. *P. sicula*, a Sicilian species, had likewise been employed for making paper. *P. corymbosus* is extensively used in India for the manufacture of the celebrated Indian matting.

PAR, OR PARR.—A fish, formerly supposed to be a distinct species of the genus *salmo*, but now known to be the young of the salmon. (*See* SALMON.)

PARA GRASS. (*See* PIASSABA.)

PARABOLA, *pa-rab'-o-la*. (*See* CONIC SECTIONS.)—A *paraboloid* is a solid figure traced by a parabola revolving round its principal axis.

PARADISE, BIRD OF. (*See* BIRD OF PARADISE.)

PARAFFIN, *par'-af-feen*.—A waxy substance obtained by the dry distillation, at a low temperature, of wood, coal-tar, peat, petroleum, and other bodies of a similar nature. Its most abundant source, however, is Boghead coal, from which it is now extracted in enormous quantities

PARAGUAY TEA. (*See* MATÉ.)

PARALLAX, *par'-al-laks* (Gr., *parallaxis*, aberration).—An astronomical term signifying the change of place in a heavenly body in consequence of being viewed from different points. The difference between the place of a celestial body, as seen from the surface and from the centre of the earth at the same instant, is called the *diurnal parallax*. The change of place in a celestial body, in consequence of being viewed from the opposite extremities of the earth's orbit, is called the *annual parallax*. It is from the parallax in the abstract that we derive all our knowledge of the distance and magnitude of the bodies which are visible in the heavens. The determination of the annual parallax of the stars attracted the attention of astronomers upon the restoration of the true system of the universe by Copernicus.

PARALLEL LINES, *par'-al-lel* (Gr., *parallelos*, beside; *allelon*, of one another).—Lines which, throughout their entire length, are at an equal distance from each other.

Parallels of Latitude.—Imaginary lines round the earth parallel to the equator, employed by geographers for reckoning degrees of latitude. (*See* LATITUDE and LONGITUDE.)

Parallel Forces.—In Mathematics, those forces which act upon a body in directions parallel to each other, as the action of the force of gravity on the separate particles of which every body is composed.

PARALLELEPIPED, OR PARALLELOPIPIDON, *par-al-lel-e-pi'-ped*, *par-al-lel-o-pip'-e-don*.—A six-sided solid, each face of which is a right-angled figure, and any two opposite faces equal, similar, and parallel. A cube is, consequently, a parallelepiped.

PARALLELOGRAM, *par-al-lel'-o-gram*.—A four-sided right-angled figure, the opposite sides of which are equal. The square is a familar example.

PARALYSIS, OR PALSY, *par-al'-i-sis* (Gr., *paralusis*, relaxation).—The loss of the natural power of motion, and sometimes of sensation, in any part of the body. It is owing to some diseased condition of the nervous system, either of the brain or spinal cord, or of the nerves. If the nerves of sensation or their centres be affected, there will be loss of sensation; if of motion, then loss of motion: to the latter of which the term paralysis is by some exclusively applied. Each of these kinds may, again, be general or partial, or may have various degrees of severity. It may affect only one nerve or muscle, or it may affect a number. The most usual form is when one side or half of the body is deprived of sensation or motion, or both, called *hemiplegia*; *paraplegia* is when the lower part of the body is paralyzed, while the upper retains both sensation and motion; and general paralysis is when the loss of nervous power extends over nearly every part of the body. In hemiplegia, the seat of the disease is one side of the brain, usually that opposite to the affected side of the body; in paraplegia, the lesion is within the spinal cord; and when more limited in extent, the disease usually arises from some abnormal state of a particular nerve. Paralysis frequently follows apoplectic attacks, and this usually in its most severe and dangerous form. The prognosis must be looked on as extremely unfavourable when the attack is sudden, the paralysis extensive and complete, and the loss of consciousness protracted; while, on the other hand, when the paralysis advances gradually, there is more reason to hope for prolonged life, if not for a complete restoration of health. Among the other causes that may give rise to paralysis are various injuries and diseases of the brain or spinal cord, as tumours, inflammation, external injuries, &c. When paralysis takes place without any previous apoplectic attack, the premonitory symptoms are a general torpor or lassitude, occasional giddiness, or a sense of weight and pain in the head, and loss of memory. When it is the result of injury of the spinal cord, then, of course, the paralysis takes place instantly. Paraplegia sometimes lasts for many years without greatly interfering with any function except locomotion; but when it occurs during fevers and advances rapidly, it is of a very sinister augury, especially if it involve the phincter muscles of the anus and bladder. Sometimes there is a gradual loss of power in the muscle or muscles affected; and in many cases the loss of power is preceded by severe pains in the part, cramps, a sense of numbness or tingling, and a curious feeling of coldness. Paralysis is not a disease of itself, but only a sign of some disorder of the nervous system, probably at a distance from the parts affected. In each case, therefore, the cause of the disorder is to be investigated, and the mode of treatment principally directed to its removal. *Facial Palsy* produces a remarkable effect on the countenance, one half of the face being entirely incapable of any movement of expression, while the other half retains its mobility. *Shaking Palsy* is an involuntary trembling motion of the body, with a tendency to pass from a walking to a running pace. A modification of this affection is frequently produced by the fumes of mercury or lead.

PARASITIC ANIMALS, *par-a-si-tic.*—Those which live on the bodies of other animals. (*See* ENTOZOA.)

Parasitic Plants.—Plants which grow on other plants, deriving substance from their juices. (*See* ENTOPHYTES.)

Parasitic Diseases.—Morbid affections produced by the presence of parasitic animals or vegetables in some of the tissues or organs, or upon the surface of the body of man or other animals.

PARELLA, *pa-rel'-la.*—A species of lichen (*Lecanora parella*), and the name is also sometimes given to those crustaceous lichens which are used to produce archil, cudbear, and litmus.

PARHELION, *par-he'-le-on* (Gr., *para*, near; *helios*, the sun).—A mock sun, frequently seen in the polar circle, and one of the finest of the luminous meteors of our atmosphere. It presents the appearance of halos and luminous arcs, intersecting with mathematical precision, and studded with solar images. In all descriptions of this phenomenon, reference is made to a remarkable regularity, although occasionally some parts may be wanting. The circles which most frequently appear are those which surround the true sun, and that one which passes through his disc parallel with the horizon. Besides these, tangential arcs are frequently observed. Occasionally segments of vertical circles render the meteor more complicated. Two appearances of parhelia are recorded by Aristotle, and Pliny mentions their occurrence at Rome. In England the phenomenon is said to have been witnessed in the year 346, when, besides the true sun, four mock suns were visible; and there are various other records of the phenomenon. Parhelia, with their accompanying luminous circles and segments, depend on the combined reflections of the solar rays from the facets of snowy prisms floating in the atmosphere. When the snowy crystals are both prismatic and lamellated, the rays suffer both refraction and reflection, and the result is a combination of excentric circles. *Para-selene* is a similar phenomenon to that described above, occurring at night when the moon is shining. Shakespeare refers to both these phenomena. In the *Third Part of King Henry the Sixth*, Prince Edward exclaims to his brother, Richard of Gloucester,

"Dazzle mine eyes, or do I see three suns?"

And Richard replies:—

"Three glorious suns, each one a perfect sun!
Not separated with the racking clouds,
But severed in a pale clear shining sky.
See, see, they join, embrace, and seem to kiss."

In *King John*, Hubert hurries to tell the king:—

"My lord, they say five moons were seen to-night:
Four fixed, and the fifth did whirl about
The other four in wondrous motion."

PARIETARIA, *pa-ri-e-tai'-re a* (Lat., *paries*, a wall).—A genus of the Nettle order, *Urticaceæ*. *P. officinalis* is the wall-pellitory, by many regarded as a valuable diuretic and lithontriptic.

PARINARIUM, *pa-re-nai'-re-um* (so named from *parenari*, the name of one of the species in Guiana).—A genus of the natural order *Rosaceæ*, sub-order *Chrysobalaneæ*, including several valuable fruit-trees. *P. excelsum* yields the fruit known in Sierra Leone under the name of the rough-skinned or gray plum.

PARIS, *par'-is.*—A genus of endogenous plants of the natural order *Trilliaceæ*. One species (*P. quadrifolia*), popularly known as Herb Paris, is common in most shady situations in some parts of the country. It is about a foot high, bearing one flower, which produces a berry, the juice of which has been employed as a remedy for inflammation of the eyes; but the berry itself is narcotic and poisonous. The root has been used as an emetic.

PARIS BASIN.—The name given by geologists to the Eocene beds which rest in a hollow of the chalk in the district surrounding Paris. They stretch for 180 miles from north to south, and 90 miles from east to west. An immense number of fossils of mammals, birds, crocodiles, fresh water fish and shells. A study of these fossils enabled Cuvier to establish the basis of the science of Palæontology (which *see*).

PARKINSONIA, *par-kin-so'-ne-a.*—A genus of plants of the natural order *Leguminosæ*, and the sub-order *Cæsalpinieæ*. The best-known species, *P. aculeata*, a shrub, or small tree, native of the West Indies and now cultivated in India, is a very beautiful object, with large yellow flowers spotted with red. The use of it in hedges, for which the strong spines make it fit, has gained for it the name of the Barbadoes flower fence. The fibre of the bark is fine and white, but not very strong.

PARMELIA, *par-me'-le-a.*—A genus of lichens. *P. parietina* (the common yellow wall lichen) was formerly regarded as a valuable febrifuge, astringent, and tonic. It contains a yellow crystalline colouring matter, called *chrysophanic acid*, which is identical with the colouring principle of rhubarb. *P. perlata* is employed in the manufacture of orchil and cudbear.

PARMENTIERA. (*See* CRESCENTIACEÆ.)

PARONYCHIACEÆ, OR ILLECEBRACEÆ, *par-o-ne-ke-ai'-se-e, il-le-se-brai'-se-a* (Gr., *para*, near; *onux*, a nail; supposed to cure a tumour which rises near the nail).—The Knotwort family, a natural order of *Dicotyledones*, sub-class *Calyciflore*, consisting of 24 genera of herbs and shrubs, found in barren places in the south of Europe and the north of Africa. None of the plants are of any particular importance.

PAROTID GLAND, *pa-rot'-id* (Gr., *para*, and *ous*, *otos*, the ear.)—The largest of the salivary glands, and is so named because it is situated near the ears. It is subject to tumours, which are often difficult to remove.

PAROXYSM, *par'-oks-izm* (Gr., *paroxusmos*).—A fit or periodical exacerbation of a disease that occurs at intervals, or has decided remissions or intermissions, as in the case of ague, gout, insanity, &c.

PAROQUET, OR PARRAKEET, *par-ro-keet'* (Fr., *perroquet*).—A bird belonging to the genus *Palæornis*, of the family *Psittacidæ*. It is distinguished by having the bill thickish, with the upper mandible dilated, the culmen rounded, the inferior mandible wide, short, and emarginate, and the tongue thick and smooth. The wings are of mean length, and the three first quill-feathers the longest, and nearly equal; exterior webs of the second, third, and fourth quills dilated near the middle, and tapering towards the apex. Tail graduated, with the two middle feathers slender, and greatly exceeding the rest in length, with their tips rounded. The feet have the tarsi rather short, and the claws strong and falcate. The different species of the genus *Palæornis* known to naturalists are natives of India, the Indian Archipelago, and Africa, with one exception—the *Palæornis Barrabandi*, which is a native of Australia. This latter specimen is also called the Barraband ring-paroquet, and in size it is about fifteen inches long, of which the tail alone measures over eight. The bill is red; the throat and fore-neck yellow; the space below the bill, eyes, and ear-coverts, grass-green; a red collar round the neck; the upper and under surface of the body green, tinged with blue upon the back part of the head and outer margins of the quill-feathers; the upper surface of the tail green; the under surface of the wings and tail blackish brown; and, finally, the legs are black. The Alexandrina ring-paroquet (*P. Alexandri*) is another handsome variety of this bird, and it was first brought by the Greeks from the island of Ceylon during the Macedonian expedition. It is very docile, and has a facility of pronunciation not inferior to any other of the parrot family. The Malacca ring-paroquet (*Palæornis Malaccensis*) is another variety, and, as its name implies, is a native of Malacca. The Caroline paroquet (*Psittacus Carolinensis*) is another member of this family, and is the only variety of the parrot family found in America. This species is about fourteen inches long and twenty-two across the wings. The forehead and cheeks are orange-red, the rest of the head and neck a rich yellow; wings edged with orange-red. The body is of a bright yellowish glossy green colour above, with bluish reflections, which are shaded with yellow on the under part of the surface; the tail long and graduated, with the exterior feathers only half the length of the middle ones; the bill white, the claws black, the feet flesh-colour, and the iris hazel. Audubon describes these paroquets as very destructive to husbandmen and gardeners, as they destroy vast quantities of grain and fruit every year.

PARROT, *par'-rot.*—A bird (*Psittacus*) belonging to the order *Insessores*, and its division *Scansores*, in accordance with its climbing powers. The family consists of nearly 200 different species, and is not less remarkable for the peculiarity of their form, and the gay and splendid plumage in which the birds are attired, than for the intelligence and docility so many of them evince in a state of captivity or domestication, and the peculiar facility possessed by some species of imitating the intonations of the human voice, and learning by rote words and sentences which they remember and repeat with clearness and precision. The general characters of the family may be stated as follows:—Bill convex, large, deflected, thick and strong, the upper mandible overhanging the under, hooked at the tip, and furnished with a small cere at the base; the under mandible strong, thick, ascending, and forming, when closed, an angle with the upper one. Tongue thick, fleshy, and soft; nostrils round, and placed in the cere at the back of the bill; feet scansorial, and the external toes longer than the inner. The bill is furnished with strong additional muscles, and the intestinal canal is of great length, and is destitute of cœca. Many of the species appear gregarious, and, except during the breeding season, are always seen in large numbers together; other species, as the cockatoos, are met with only in pairs. They select the hollows of decayed trees for the purpose of hatching their eggs and rearing their young; and they make no nest, but deposit their eggs upon the bare wood. The eggs vary in number from two to five or six. Their natural voice consists of hoarse or shrill piercing screams, with but little modulation. Their power of imitating the human voice is not possessed by all the species, but is confined to a few, particularly to the short even-tailed parrots, which have the tongue large, broad, and fleshy at the tip. Parrots are found in America as far south as the Straits of Magellan, and likewise in Australia and Tasmania. The Caroline Parrot (*Conurus Carolinensis*) of North America extends to a higher northern latitude than any other of the family. Its body is about seven inches long, and it has a tail of equal length. The general colour is green, shaded with blue, and diversified with orange and black. It is easily tamed, but cannot be taught to speak. The first sub-family is that of the Macaws (*Macrocercinæ*), which will be found described under article MACAW. The next subdivision is termed the family *Palæornina* (*see* PAROQUET); and next come the *Psittacidæ*, under which title is comprehended that class of birds which we more strictly denominate Parrots. Wagler, in his "Monographia Psittacorum," has divided these into four genera—*Eclectus*, *Psittacodis*, *Psittacus*, and *Pionus*. The plumage of these is compact, and the feathers of the neck broad, truncate, and imbricated. With the exception of the gray parrot (*Psittacus erythacus*, Linn.), these are all inhabitants of the continent of America. The prevailing colour of their plumage is green, varied with red, blue, and yellow. First among these is placed, by Mr. Selby, the festive parrot (*P. festivus*), which is a native of Guiana, Cayenne, and the Brazils, in South America. It measures between fifteen and sixteen inches in length, and its plumage is nearly a prevailing green colour. The gray parrot is a native of Western Africa, and is one of the best-known species of the tribe. Its imitative and talkative powers are unequalled by any of the others, and consequently it is much in request as an amusing companion. It is about twelve inches in length, and the whole of its plumage, with the exception of its tail, which is bright scarlet, is ashy gray, deepest in colour on the back. The grand eclectus (*Eclectus grandis*, Wagler), the southern Nestor (*Nestor hypopolius*), and several others, may be mentioned as members of this family. The *Loriana* form a separate branch, and are so named on account of their beautiful scarlet colour and their call-note, which resembles their name. The *Lorikeets* are a subdivision of these last-mentioned species, and they present the characteristics of the paroquets mingled with those of the lory. (*See* COCKATOO, MACAW, &c.)

PARSLEY. (*See* PETROSELINUM.)

PARSNIP, *parsnip*.—A genus of plants (*Pastinaca*) of the natural order *Umbelliferæ*. The common Parsnip (*P. sativa*), a native of England, is in great favour as a culinary vegetable, growing best in chalky and gravelly soils, and is found also in many parts of Europe, and of the north of Asia. The root of the parsnip, resembling the carrot in shape, but not in colour, is nutritious, but too sweet in flavour to suit all tastes. In some parts of Europe, and in the Channel Islands it is cultivated as food for cattle, who are very fond of it, and cows feeding on it in winter supply milk of a superior quality. In some districts of England and Ireland, parsnip wine is made, and in the north of Ireland a fermented liquor is produced from the parsnip.

PARTHENOGENESIS, *par'-then-o-gen'-e-sis* (Gr., *parthenos*, a virgin; and *genesis*, the act of production).—A word adopted by Professor Owen to indicate propagation by any mode except that of impregnation, such as by self-dividing.

PARTRIDGE, *par'-tridje*.—A bird (*Perdix*) belonging to the gallinaceous family of birds termed *Tetraonidæ*. The characteristics of the common, or gray partridge (*Perdix cinerea*) are as follows: Bill short, strong, naked at the base, upper mandible convex, deflected towards the tip; nostrils basal, lateral, and the orifice partly concealed by a naked arched scale; wings short, concave, and rounded in form, the first three feathers shorter than the fourth or fifth, which are the longest in the wing; tail short; feet with three toes in front and one behind, and those in front united by a membrane as far as the first articulation. The adult male of the partridge has the beak bluish-white; the front of the neck and throat a bright yellowish chestnut; top of the head and back of the neck grayish-brown; the back and wing-coverts grounded with wood-brown and shaded with chestnut-brown, the shaft of each feather being conspicuous in a streak of wood-brown; the tail-feathers of a uniform reddish-chestnut; the neck and upper part of the breast, the sides, and flanks, light bluish-gray, freckled in minute spots with a darker shade of the same colour, and barred with chestnut; the legs and toes bluish-white; and, lastly, the claws brown. The entire length of this bird is about twelve inches. The female is a little smaller than the male, and the gray feathers on the neck and under surface of the body are more tinged with brown. The birds pair in February, but very seldom commence to lay eggs before April or the beginning of May. Their nest is very simply constructed, as a slight depression of the ground, and a few leaves and pieces of grass scratched together, serve for the purpose. From twelve to twenty eggs are mostly produced, and they are of a uniform olive-brown colour, and about an inch and five lines in length and an inch broad. The period of incubation lasts twenty-one days, and both the male and female birds exhibit great solicitude for the covey as soon as they emerge from the shell. Partridges are carefully reared and preserved for the shooting season; and it is against the game laws to touch them until it commences, which it does on the 1st of September. Besides the common partridge, there are several other varieties: as the red-legged partridge (*Perdix rufus*), the Barbary partridge (*Perdix petrosa*), and the American partridge, called also the Virginian colin (*Perdix Virginiana*).

PARTRIDGE PIGEON.—An Australian bird (*Geophaps*) of beautiful plumage, and highly esteemed for the table. There are several kinds, all members of the *Columbidæ*, though resembling the partridge in many of their habits. A West Indian bird, the partridge dove (*Geotrygon montana*), is another species of the same genus.

PARTRIDGE-WOOD. (*See* ANDIRA and HEISTERIA.)

PASENG, *pas'-eng*. (*See* ÆGAGNIS.)

PARTURITION, *par-tu-rish'-un*.—The act of giving birth to a child. (*See* MIDWIFERY.)

PASPALUM, *pas'-pa-lum* (from *paspalos*, one of the Greek names for millet).—A genus of grasses. *P. exile* yields the smallest known cereal grain, *Fundi* or *Fundungi*, which is used as food on the west coast of Africa. In Sierra Leone, it is commonly called millet. *P. scrobiculatum* also yields a kind of grain known in India as the *Menya* or *Koda*. (*See* MILLET.) Some of the species, especially *P. purpureum*, are of value as fodder grasses.

PASQUE FLOWER, *pask*.—A genus of plants (*Pulsatilla*) of the natural order *Ranunculaceæ*. They are perennial herbaceous plants, and are narcotic and poisonous. The common pasque (*P. vulgaris*) is well known in this country for its wide, bell-shaped, purple flowers. A European species, not growing in Britain (*P. pratensis*), has bell-shaped flowers of a blackish purple colour. The odour of these plants, when pressed, is pungent, due to an essential oil, which forms an acid substance known as pulsatilla camphor, sometimes used in medicine, especially by practisers of homœpathy.

PASSENGER PIGEON.—A species of pigeon (*Ectopistes migratorius*). It has a more slender bill than the ordinary pigeon, the head is small in proportion to the body, the legs short and strong, the wings long and pointed, and the tail wedge-shaped and about eight inches long, the body being of similar length. It is found in all parts of North America, and is commonly known as the wild pigeon. The plumage is finely coloured. It has extraordinary powers of flight, travelling immense distances at the rate of a mile a minute; and has been known to cross the Atlantic to this country. They are not, in the ordinary sense, migratory birds, but travel in search of food. The flocks frequently seen flying together must include several millions of birds; and it has been estimated—calculating from the known rapidity of flight and the time occupied in passing a particular spot—that in some of their great expeditions, the mass of birds is a mile wide and 150 miles long. Their roosting and breeding-places are of enormous magnitude. It is said by some of the naturalists who have given attention to the habits of these remarkable birds, that "the noise of wings and of cooing voices is as loud as thunder, and is heard at the distance of miles, and it drowns the report of guns." The branches of large trees break down under the weight of the roosting birds. The flesh, especially of the young pigeons, is much liked.

PASSERINE BIRDS. (*See* INSESSORES.)

PASSIFLORACEÆ, *pas-se-flo-rai'-se-e.*—The Passion-flower family, a natural order of *Dicotyledones*, sub-class *Calyciflorœ*. They are herbs or shrubs, usually climbing by tendrils, and of rapid growth. The plants of this order are chiefly found in tropical America; but a few also occur in North America and the East Indies, and several in Africa. There are 13 genera and 211 species. Many are cultivated for the beauty of their flowers and foliage. The genus *Passiflora* has long been a favourite with florists, the flowers being large and beautiful. The fruits of several species of passion-flower are eaten, under the name of granadillas. Species of *Paropsis* and *Tacsonia* also bear edible fruit; but the fruit of other species is repulsive and almost poisonous. The roots and flowers of some species possess medical properties. In Jamaica a tincture of the flowers of *P. rubra* is used as a substitute for laudanum. The name given by the old botanists to the passiflora was *flos passionis* (passion-flower), because the instruments of the Saviour's passion or suffering were thought to be represented in the parts of fructification. The filamentous processes were supposed to represent the crown of thorns; the nail-shaped styles, the nails of the cross; and the five anthers, the marks of the wounds.

PASSION-FLOWER. (*See* PASSIFLORACEÆ.)

PASTINACA, *pas-te-nai'-ka.* (*See* PARSNIP.)

PATELLA. (*See* KNEE.)

PATHOLOGY, *path-ol'-o-je* (Gr., *pathos*, disease, and *logos*, discourse).—The science or doctrine of disease. As physiology teaches the nature of the functions of the living body in a state of health, so pathology relates to the various derangements of those functions which constitute disease. It is usually divided into general and special pathology. As each disease is marked by certain peculiarities which distinguish it from all others, there must be a pathology of each, or, in other words, a special pathology; and as, on the other hand, many diseases possess certain features in common, the description of these features will no longer be special, but general pathology. The latter is nothing more than a generalization of the facts of the former. It is made up of individual facts, carefully observed, arranged, and classified, according to some nosological plan. General pathology collects those facts, wherever found, which have a certain similarity, and arranges them according to their natural analogies, so that whoever examines them in this view, will have no difficulty in appreciating them as phenomena of particular diseases. Disease is a change from the natural condition of the function or structure of the body, and usually involves several elementary functions, or structures. A knowledge of the constituent parts or elements of structure and function is necessary to the pathologist in the study of disease before he can properly understand their combinations.

PAUCHONTI TREE, *pau-kon'-te.*—A large forest tree of India (*Isonandra polyandra*), of the same genus with the gutta-percha tree, and producing a similar substance. The timber is valuable for its tenacity, in which respect it equals teak.

PAULLINIA, *pawl-in'-e-a.*—A genus of the natural order *Sapindaceœ*. The species *P. sorbilis* is the source of *guarana*, or Brazilian cocoa. The dried seeds are deprived of their husks, and pounded and kneaded into a mass, which is afterwards made into oblong or rounded cakes. (*See* GUARANA BREAD.) It contains an alkaloid, to which the name *guaranine* has been given, but which appears to be identical with *caffeine*, the active principle of both tea and coffee.

PAVIA, *pai'-ve-a.* (*See* HORSE CHESTNUT.)

PAVONIDÆ, *pa-von'-i-dee.*—Another name for the family of gallinaceous birds usually spoken of as the *Phasianidœ*, although, properly speaking, they belong more particularly to those members of the family which have a greater expansion of tail, as the peacock. (*See* PEACOCK.)

PEA, *pee.*—A genus of plants (*Pisum*) of the natural order *Leguminosœ* (q.v.), sub-order *Papilionaceœ*. Two species (of which there are several varieties) are grown in Britain for the sake of their seeds; these two species are the *Garden Pea* and the *Field Pea*. The seeds of the latter (called peas, or pease, after being *shelled*), and split peas, are much used for making pea-soup. As a rule, peas will not thrive except in a somewhat calcareous soil. The *Sweet Pea* and *Everlasting Pea* belong to the family *Lathyrus* (which see).

Pea Beetle, or Pea Chafer.—A small coleopterous insect found in the south of Europe and in North America, and very destructive to crops of peas. Its eggs are laid in the young pea-pods, one for each pea.

Pea Crab.—A genus (*Pinnotheres*) of very small brachyourous crustaceans which live within the mantle-lobes of certain molluscs. Species are found in all parts of the world, and one is very often found in the mantle-lobes of the mussel on British coasts.

Pea Maggot.—The caterpillar of a small moth (*Tortrix Pisi*) common in Britain, which lays its eggsi n the pods of peas. When the caterpillar emerges from its egg it lives on the pea; and in wet seasons pods are frequently found full of these little creatures.

PEACH.—A tree (*Amygdalus Persica*) yielding a delicious fruit, much cultivated in temperate climates in Europe and America. It is a native of Persia, and is of the same genus as the Almond. The *Nectarine* is very similar to the peach, only it is more tender, and the skin of the fruit is smooth, whereas that of the peach is covered with a beautiful down. (*See also* AMYGDALEÆ.)

PEACH WOOD, OR LIMA WOOD.—A term applied to certain wood imported from South America, which yields a fine peach colour, for dyeing and calico printing, &c. It is believed to be the produce of a species of *Cæsalpinia*.

PEACOCK, *pe'-kok* (Sax., *pawa*).—A member (*Pavo*) of the *Pavonidæ*, a family of rasorial birds. There are two species of the peacock known, both inhabiting the continent and islands of India; and they present the most splendid plumage of the whole feathered world. The beauty of the peacock attracted notice even at the earliest times; for it is mentioned (2 Chron. ix. 21) as having been brought by Solomon's mariners to their royal master. The peacock is also mentioned in 1 Kings x. 22, and Job xxxix. 13; but modern scholars are generally of opinion that in these cases the Hebrew word should be translated "ostrich." Next we hear of it as having been discovered by the army of Alexander; and hence it found its way into Greece, Rome, and Europe. It had, amongst the Romans, to perform an honourable part in their luxurious entertainments; and it was thought worthy of being dedicated to Juno, and of being imprinted on the coinage of the era. At an early period of English history the peacock was known; and there was scarcely any noble feast at which a roast peacock did not make an imposing appearance. They were stuffed with spices and sweet herbs, roasted and served up whole, and covered, after dressing, with the skin and feathers. In our own times, peacocks are reared in our gardens and lawns, more for ornamental than for culinary purposes. In their native countries, magnificent dresses are made of peacocks' feathers and trains, and a sunshade of the gorgeous feathers of this bird is thought the great attribute of nobility in the island of Java. The Javanese peacock (*Pavo Japonensis*) is the less splendid of the two species known. It is nearly similar in size to the common peacock, but the whole plumage is of a more subdued brilliancy. The bare space upon the cheeks and below the eyes is of a fine gamboge-yellow. The head, neck, and fore part of the breast are of a peculiar greenish tint, being brilliant with golden reflections in some lights, in others appearing dull and subdued. The lower parts are of a dull, deep, greenish-brown, instead of the rich blue of the well-known bird. The train is not so ample in proportion, and the eyes, or moons, are less numerous; the centre of each is rich blue, encircled with green, brown, and finally with a bronzed ring. The Javanese peacock is a native of Java, Sumatra, and Burmah, as well as other parts of India. The common peacock (*P. cristatus*) differs but little from the one last described, except in the increased splendour of its plumage and the altered form of its crest. It has been long naturalized in Europe, and in England it may be now looked upon as nearly a native bird. Peacocks' feathers have lately come into fashion in the æsthetic style of house decoration.

PEACOCK STONE, also called BLACK OPAL. (*See* OPAL.)

PEA ORE.—A compact iron ore (hydrated peroxide of iron), very abundant in certain parts of France, and occurring in round smooth grains.

PEAR, *pear*.—A fruit tree (*Pyrus communis*) cultivated in temperate climates. (*See* PYRUS.) It grows also in a wild state in this country, on the continent of Europe, and in the temperate parts of Asia, and in that condition is either a large shrub or a small thorny tree, with small, hard fruit. The cultivated tree is without thorns, and grows to an average height of nearly 50 feet. The fruit, of which there are many varieties, is hemispherical at one end, and tapers gradually at the other. Some of the finer sort are cultivated as wall trees, and are well adapted for training as espaliers. Some pears ripen early in autumn, and some not till the beginning of winter. The wood of the pear tree is of a reddish colour, hard, and fine grained, and when dyed black greatly resembles ebony. It is used for articles of turnery, and for the bolder style of wood-engraving, for which large blocks are required.

PEAR, PRICKLY. (*See* OPANTIA.)

PEARL, *purl* (Sax., *pearl*).—A substance formed by certain bivalve molluscs allied to the oyster, and consisting of alternate concentric layers of membrane and carbonate of lime. The pearl oyster (*Meleagrina margaritiferus*) belongs to the genus *Avicula*, has an equivalve shell, nearly semicircular in form, greenish in appearance without, and ornamented with the most beautiful nacre secretion lining the shell within. (*See* MOTHER-OF-PEARL.) The shell is furnished with a rectilinear hinge, frequently extending into rings by its extremities, and furnished with narrow elongated ligaments, and occasionally with small notches near the mouth of the animal. Small pearls are found in the shells of an oyster (*Placuna placenta*) found in the China Sea, and very fine pearls have occasionally been found in the English fresh-water mussel. The pearl oysters live in the warm seas of the East and West Indies, and they are found in large clusters, hanging on to rocks and other substances at the greatest depths. The places which they inhabit are termed "pearl-banks," and the most famous of these are off the west coast of Ceylon, at Tuticorin off the Coromandel coast, at the Bahrein Islands in the Gulf of Persia, at the Sooloo Islands, off the coast of Algiers, off St. Margarita in the West Indies, and in the Bay of Panama. They have also been found off the Scotch coast, and indeed in various other places, but not in numbers sufficient to be noted, or to cause the fishery to be prosecuted. It appears that the ultimate cause of the oyster forming this beautiful substance is to get rid of a source of irritation. Sometimes a grain of sand, or some such small foreign body, has insinuated itself between the mantle of the oyster and the shell, and proves a great annoyance, so the animal covers it with a smooth coat of membrane, over which it spreads a layer of nacre. At other times, it is caused by some enemy of the inhabitant of the shell perforating it from the outside to get within reach of its prey. With a plug of this same matter, the oyster immediately fills up the opening made, and shutting out the intruder, balks it of its nefarious design. In both these cases we find the pearl usually adhering to the internal surface of the shell. The best, however, and the most valuable specimens, are generally found in the body itself of the animal; and the source of irritation is here proved to be the ovum or egg of the animal, which, instead of becoming ripe, proves abortive, and is not thrown out by the mother along with the others, but remains behind in the capsule in which the ova are generally contained. This capsule, being still supplied with blood-vessels from the parent animal, goes on increasing in size for another year, and then receives a covering of nacre, the same as the animal spreads over the internal surface of the shell. The pearls found in the substance of the animal are generally round, but they are occasionally pear-shaped, in consequence of the pedicle by which the egg is attached being covered by the nacre as well as the egg itself. Pearls are very valuable. The best are of clear, bright whiteness, free from spot or stain, and with their surface naturally smooth and glossy. The largest reach the highest prices; and those of a round form are preferred, although those of the pear-shape are extensively used for ear-rings.

Seed Pearls are those about the size of small shot. These latter are usually exported to China, which does an extensive trade in them.

PEARL BARLEY. (*See* HORDEUM.)

PEARL OYSTER. (*See* OYSTER and PEARL.)

PEA STONE, PISOLITE (*pi'-so-lite*), OR PISIFORM LIMESTONE (*pi'-si-form*).—Calcareous spars occurring in globules of one-eighth to half an inch in diameter, and found in cement of similar material. A grain of sand usually forms a nucleus, though sometimes a bubble of air may answer the purpose.

Pea Weevil (*Sitona crinita* and *Sitona lineata*).—Certain coleopterous insects, about a quarter of an inch in length, very destructive to peas. Ashes, particularly wood-ashes, lime and soot dusted over the plants are a protection from their ravages.

PEAT, *peet*.—An accumulation of vegetable matter found wherever the soil has been long soaked with water which has no outlet, and does not entirely evaporate with the sun's heat. In colour, peat is generally black or dark brown, or, when of recent formation, of a yellowish brown. It is soft, and of a viscous consistence, but darkens and turns hard when exposed to the air. When thoroughly dried, it may be set on fire; it burns slowly, giving out a gentle heat, with little smoke. The burning of peat destroys the vegetable matter, and leaves a residue of earth and salts. This residue is very valuable as a manure, especially for clovers and herbaceous plants, of which the leaves and stems are the most valuable parts. The smoke from burning peat has a characteristic odour, which it communicates to objects with which it comes in contact. This flavour is highly esteemed, by some persons, in spirits which have been distilled in vessels heated with this sort of fuel. In all parts of the world peat is found; it is, however, more abundant in the cold, moist climates of temperate latitudes. In the western counties of England, in the western part of the Lowlands of Scotland, in the Highlands, and in Ireland, large portions of the country are covered with peat. In Ireland alone there are said to be 3,000,000 acres of bog, yielding peat, or turf, as it is locally named. Peat-cutting takes place in spring and summer.

PEBBLES, *peb'-blz* (Sax., *pabob*, a pebble).—A general term applied to water-worn minerals, and popularly signifying a roundish stone of any kind, from the size of a nut to that of a man's hand. In a scientific sense, pebbles are distinguished from other silicious minerals by their variety of colours.

PECCARY, *pek'-ka-re*.—An animal (*Dycoteles*) belonging to the family *Suidæ*, and common in South America. According to the description of Cuvier, the intermediate toes are larger than in *Sus* (*see* HOG), and touching the ground. The grinders and incisors are very similar to those of the hog, so called, but whose canines, directed like those of animals in general, do not project from the mouth. There is no tail, and there is a glandular opening upon the loins, where a fetid odour is secreted. The metatarsal and metacarpal bones of the two great toes are united into a sort of common bone, like those of the *ruminantia*, with which their stomach, divided into several sacs, gives them also a remarkable relation. Only two species are known—*Dycoteles torquatus*, common, or collared peccary; and *Dycoteles labiatus*, or white-lipped peccary. The first species inhabits the eastern side of South America, and frequents the forests there, living on vegetables and roots. Its hairs are alternately ringed with black and yellowish-white. They are stiff in the dried skin, having the rigidity of bristles; and along the neck and back they are very long, and form a kind of bristly mane, which is erected on the slightest irritation. The flesh is said to be very like pork, but harder, and not so sweet. The food of the animals consists of acorns, roots, and mountain fruits, as well as worms and earthworms, besides similar insects. The *white-lipped peccary* is considered larger than the last-mentioned variety, and is conspicuous for the white margin of its lips. The hair on the body is brownish-black, marked with rings; and the mane and hair about the head are nearly so long as to conceal the ears. The white-lipped peccary is an inhabitant of Paraguay, and is often three feet and a half in length. These animals are gregarious, and traverse whole districts, which they lay waste, led by some old male. When attacked, they readily turn on their pursuers, and from their numbers, and the power they have, both with their tusks and teeth, often prove dangerous enemies.

PECTEN, *peck'-ten* (Lat., *pecten*, comb).—A genus of lamellibranchiate molluscs, of which there are many species found in almost all parts of the world. They are sometimes classed in the same family with the oyster. The shells usually have ribs radiating to the margin, which gives them somewhat a comb-like appearance; hence the name pecten. Some of the larger species are popularly known as clams. *P. Jacobæus*, found in the Mediterranean, and about 4 inches long, supplied the scallop-shell worn by pilgrims who had visited the shrine of St. James at Compostella.

PECTIC ACID, *pek'-tik*.—An acid found in fruits which yield jellies.

Pectine Matters.—A class of gelatinizing substances, found in fleshy fruits and in certain roots; but their properties are not yet fully investigated.

PECTINIBRANCHIATA, *pek-tin-i-bran-ki-a'-ta* (Lat., comb-gilled).—An order of gasteropodous molluscs, the gills of which are arranged somewhat like the teeth of a comb. Whelks, periwinkles, &c., belong to this order. (*See* MOLLUSCA.)

PECTIZATION, *pek-ti-zai'-shun* (Gr., *pektis*, congealed, thickened).—A term applied to the sudden change from the liquid to the solid form, which takes place in certain solutions. The solution of hydrated silicic acid, for instance, may be preserved in a fluid state for days and weeks in a sealed tube, but it is sure at last to assume the *pectous* or gelatinous form.

PECTORAL, *pek'-to-ral* (Lat., *pectoralis*, from *pectus*, the breast).—Belonging to the breast; as pectoral medicines, those which relieve diseases of the chest. The pectoral muscles, major and minor, are situated on the anterior part of the chest.

PECTORILOQUY, *pek-tor-il'-o-kwi.*—A certain sound of the voice, observable by means of the stethoscope when the lungs are affected.

PEDALIACEÆ, *ped-al-e-ai'-se-e.*—The Pedalium family, a natural order of *Dicotyledones*, sub-class *Corolliflorœ*. They are glandular herbs, found chiefly in the tropics. There are 14 genera and 25 species, chiefly remarkable for their oily seeds. (*See* BIGNONIACEÆ SESAMUM.)

PEDETES, *ped'-ee-tez.*—A genus of rodent animals belonging to the family *Muridœ*, of which the Jumping Hare of South Africa (*Pedetes Capensis*) is the best known species. This animal has long hind legs, and can jump 20 or 30 feet at one bound. The Pedetes have many characteristics similar to the *Jerboas* (which *see*.)

PEDICELLARIÆ, *ped-i-sel-la'-ri-e.*—Remarkable appendages found on the integuments of many of the *Echinodermata*. They resemble very small stalks with minute forceps at the end, which forceps are continually in action, opening and closing, and probably useful in keeping the animal free from algæ and zoophytes.

PEDICULARIS *ped-ik-u-la'-ris.*—A genus of plants two species of which are popularly known in Britain by the name Lousewort. They belong to the natural order *Scrophulariaceœ*, and are common in wet ground. They are supposed to produce the lousy disease in sheep, a supposition, however, which is quite erroneous, although their acridity causes them to be very injurious to sheep when eaten by them. There are many species, in North America, the northern parts of Asia, and on the Continent of Europe.

PEDICULUS, *ped-ik'-u-lus.* (*See* LOUSE.)

PEEPUL, PIPUL, OR PIPPUL.—Names for the sacred fig-tree (*Ficus religiosa*) of India, also called in Ceylon Bo Tree. It is a species of fig-tree, and somewhat resembles the banyan, except that the branches growing downward do not take root, and the leaves are heart-shaped with long thin points. As Vishnu is said to have been born under it, the tree is regarded as sacred. It is usually planted near temples, and devotees dwell beneath its shade.

PEEWIT. (*See* LAPWING.)

PEGASIDÆ, *peg-a'-si-dee.*—A family of small fishes of the order *Lophobranchii.* (*See* PEGASUS.)

PEGASSE, OR PACASSE, *peg-as'-see.*—A curious species of ox (*Bos pegasus*), about which little is at present known. It is found in the interior of Western Africa, having a short thick head, wide forehead, and long curiously-shaped horns, which extend first laterally, then downwards, and then upwards; the neck is heavily maned, and the tail also covered with thick hair.

PEGASUS, *peg'-a-sus.*—A genus of fishes forming the family *Pegasidœ*, having very large and strong pectoral fins, a long snout projecting before the eyes, and three knobbed rings round its body. The species are found in the Indian Seas; and one (*Pegasus Draco*) is popularly known as the Sea Dragon, while another *Pegrasus volons* is the one usually termed the Pegasus.

PEKAN, *pe'-kan.*—A pretty little quadruped (*Martes Canadensis*), known also as the Wood-Shock, found in the northern parts of America, and closely allied to the sable. It is a species of marten, but twice the size of pine marten. Its fur is very useful, though not so valuable as that of the sable.

PELARGONIUM, *pe-lar-go'-ne-um* (Gr., *pelargos*, a stork, in allusion to the beak of the fruit, which resembles the bill of that bird).—An extensive genus of herbs and shrubs belonging to the natural order *Geraniaceœ*. The species and varieties are very numerous, and are commonly, but improperly, termed geraniums, as they possess some ,distinctive characteristics. (*See* GERANIUM). They are chiefly natives of South Africa, but there are some species in Australia, and are favourite objects of culture by the gardener on account of the beauty of their flowers and foliage. Nearly 200 species, besides many garden varieties, are described as being in cultivation in Great Britain. In their properties they are generally astringent. One species, *P. triste*, has tubers, which are eaten at the Cape of Good Hope.

PELECANIDÆ, *pel-eck-an'-i-dee.*—The family of birds to which th pelicans and cormorants belong. They have long straight bills, broad at the base, and frequently with a pouch below the lower mandible. Cuvier named them the *Totipalmati.* (*See also* PELICAN.)

PELICAN, *pell'-e-kan* (Gr., *pelekan*).—A bird (*Pelecanus*), belonging to the family *Totipalmati*, of the order *Palmipedes*, a class of swimming birds or *Natatores*. The pelicans reside on rivers, lakes, and along the sea-coasts; they are also excellent swimmers, and are fond of perching on trees and other eminences. They feed on fish, and by means of a remarkable pouch (suspended from the lower mandible of the long and powerful bill), they can store up a good deal of provender in one evening, when they return to their favourite haunts and disgorge their prey, to consume it at leisure. The female feeds her young on food that has been macerated for some time in her pouch. The common pelican (*Pelecanus onocrotalus*) is about five or six feet in length, and the expanse of the wings is from twelve to thirteen feet. The colour of the plumage is generally white, tinted with rose or salmon-colour, which is brightest in the breeding season. The primaries and spurious wings are black, and the crest at the back of the head yellow. The pouch is yellow, the irides hazel, and the feet flesh-colour; the tail is short. The name of the pelican is derived from its cry, which is loudest during its flight, and which the ancients used to compare to the braying of an ass. It inhabits Asia, Africa, and South America. In September, about the middle of the month, it repairs to Egypt; and in the summer months it takes up its residence along the borders of the Black Sea and the shores of Greece. With regard to its fishing and eating powers, it is said that a pelican will dispatch as many fish at a single meal as would serve for six men ; and in confinement it is known to snatch up rats and other small quadrupeds. The absurd idea which used to be prevalent, that the pelican fed its young with its own blood, was doubtless derived from its habit of feeding them from the fish in its pouch. It also carries water in its pouch for the succour of the young pelicans, which are generally two in number at a time.

PELLAGRA, *pel'-lay-gra.*—A loathsome skin disease, sometimes ending in melancholia and suicide, and supposed to result from the use of rice or maize as the chief or sole article of food ; but it is now known to have other causes. It seems to have been observed in its worst form in Lombardy and the north of Italy.

PELLITORY. (*See* ANACYCLUS.)

PELTIGERA, OR PELTIDEA, *pel-tij-e-ra, pel-tid-e-a.*—A genus of lichens. *P. canina* and *rufescens* are known in the herb-shops of this country under the name of ground liverwort. This was formerly officinal in the London Pharmacopœia, and regarded as a specific for hydrophobia.

PELVIS, *pel'-vis* (Lat., *pelvis*, a basin).—The ring of bones in the human skeleton placed between the spinal column and the thigh bones. In the adult this may be considered to consist of four distinct bones, the two ossa innominata, one on each side and meeting in front, and the sacrum and the coccyx, which are placed behind. In the youthful state, the ossa innominata is divided into three separate bones. There is a well-marked difference between the male and female pelvis, and it may also be remarked that the pelvis of the negro races is smaller than that of the European races. (*See also* ANATOMY.)

PEMPHIGUS, OR POMPHOLYX, *pem'-fig-us, pom'-fo-liks.*—A skin disease characterized by an eruption of large vesicles filled with serous fluid known as *bullæ*. The disease occurs in both acute and chronic forms, being caused by severe constitutional disturbance and by impaired nutrition. In the acute form, a mild ointment, such as simple cerate, is of value ; but the chronic form requires a course of tonics and nutritious diet.

PENÆACEÆ, *pen-e-ai'-se-e.*—The Penæa, or Sarcocolla family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*, consisting of evergreen shrubs, only found at the Cape of Good Hope. The gum-resin called sarcocolla is generally considered to be a product of plants of this order.

PENAWAR. (*See* CIBOTIUM.)

PENDULUM, *pen'-du-lum* (Lat., *pedeo*, to hang).—A heavy body so suspended that it may vibrate or swing backwards and forwards about a fixed point by the action of gravity, when it is once raised by any external force to the right or left of its quiescent position. As the action of gravity is not the same in all latitudes, nor yet at all heights above the earth's surface in the same latitude, the vibrations of the pendulum are slower at the equator than the poles, and increase in quickness with the latitudes north or south, as the centrifugal force decreases, and *vice versa*.

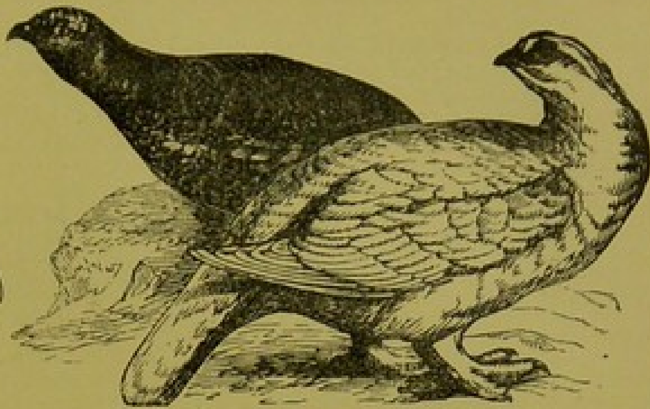
Pendulum Experiments.—The measurement of the relative force of the earth's attraction at different places has been attained by means of careful experiments with a pendulum. In the same place the seconds pendulum is always of the same length, but, in consequence of the variation of gravity, is different from different points of the earth's surface. The pendulum has also been employed to determine the mean density of the earth, by the observation of the times of vibration at the mouth and at the bottom of a coal pit. Professor Airey, the late astronomer-royal, conducted a series of experiments of this kind. (*See* EARTH.) In 1851, M. Foucault demonstrated the relation of the earth by means of the pendulum. Remarkable and very interesting experiments were conducted at the observatory at Paris, and on a much larger scale at Cologne Cathedral, the great height of the interior of which permitted the suspension of a pendulum 132 feet long. Foucault's theory was this : "I am supposing that the spectator is standing on one of the poles of the earth with a pendulum of the simplest make, consisting of a ball suspended by a pliant thread to an absolutely fixed point. The cause of the pendulum's oscillation is easily ascertained, and it presents an unchanged position in space. If, then, the oscillations are kept up for a sufficient length of time, the movement of the earth from west to east will gradually become visible by its contrast with the immobility of the pendulum's plane of oscillation. If the oscillation was kept up for twenty-four hours, the revolution round the point of suspension will be complete." This theory was tested by the experiments mentioned ; and although, of course, it is impossible to make the pendulum entirely independent of the earth's attraction, the result is so nearly attained that practically the result is most successful. The plane of the oscillation of the pendulum was soon visibly altered ; and at the end of half an hour the divergence was so great, as to be easily recognized by the paces on a layer of fine sand spread under a sharp point attached to the back of the pendulum.

PENGUIN, *pen'-gwin.*—A genus of birds (*Aptenodytes*) of the family *Alcidæ*, and constituting a sub-family, *Aptenodidæ*. Their little wings are covered with mere vestiges of feathers, which, at the first glance, resemble scales ; their feet, placed further behind than those of any other bird, only support them by bearing on the tarsus, which is widened like the sole of the foot of a quadruped, and in which are found those bones soldered together at their extremities. They have a small thumb directed inwards, and the three anterior toes are united by a membrane. They are only found in the Antarctic Seas, never going on shore except to build their nests, which they can only reach by painfully drawing themselves along on the under surface of their bodies. They congregate in immense numbers, and one breeding ground has been known to occupy 30 or 40 acres. While in the water they move with great swiftness, and they principally feed on fish. The female lays from two to three eggs at a time, which are generally all hatched. The largest of the species is the great King, or Patagonian Penguin (*A. Patachonica*), which is about two feet long, and weighs upwards of seventy pounds. On the place where they breed, they are seen in countless numbers lining the shore, and at a distance, from their erect attitudes, they might be mistaken for an army ready to meet invasion. They are simple, inoffensive birds, and may be knocked down easily, never stirring on the approach of the destroyer.

PENICILLARIA, *pen-i-sil-lai'-re-a* (Lat., *penicillum*, a hair-pencil, in allusion to the spikes).—A genus of grasses. *P. spicata* is commonly called Caffre corn. It yields a serviceable grain, African millet.

PENICILLIUM, *pen-i-sil'-le-um.*—A genus

PHYLLOXERA VASTATRIX.

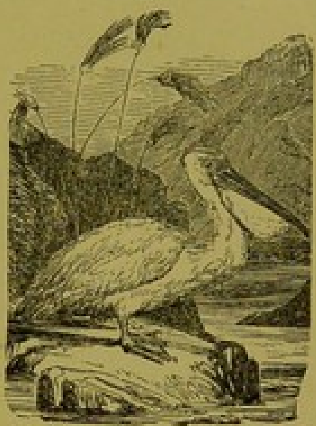


PTARMIGAN.

PARROT.

WHITE POPPY.

POLYPODURN.



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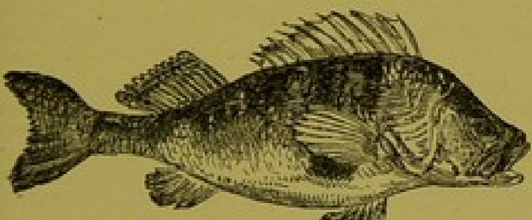
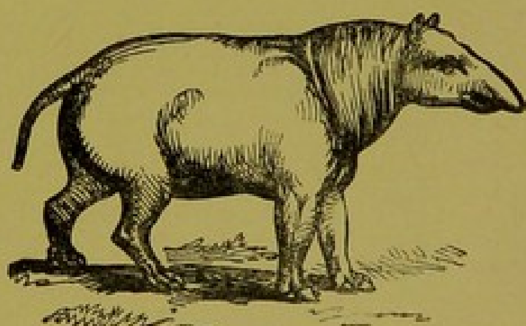


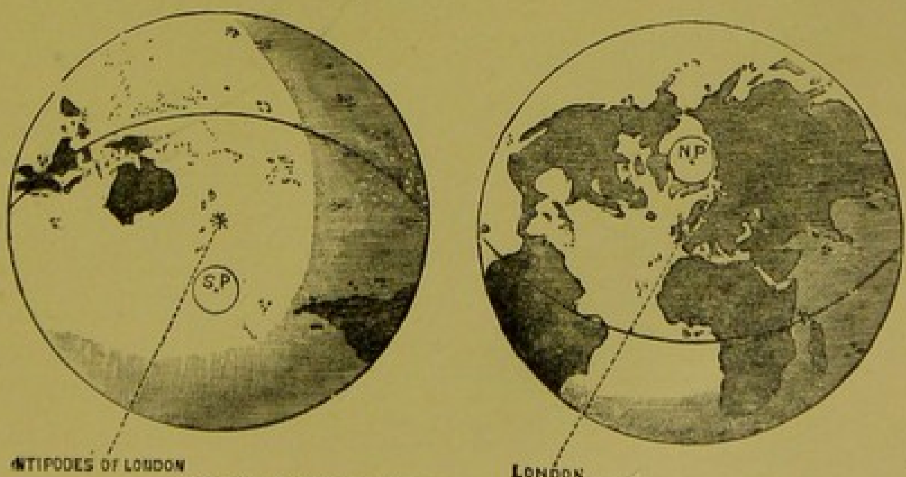
PERCH.

PLANTAIN.



THE PALEOTHERIUM.

RED POPPY.



PHYSICAL GEOGRAPHY.

of *Fungi*. Certain moulds found on bread, preserves, &c., are produced by species of this genus. The so-called vinegar-plant, which, by its growth in saccharine liquids at moderate temperatures converts them into vinegar, appears to be a mycelial state of *Penicillium glaucum;* and the yeast-plant, which, by its vegetation at a high temperature, causes fermentation in bread, beer, &c., would seem likewise to be a mycelial state of a species of this genus.

PENNATULA, *pen-nat'-u-la.*—A genus of zoophytes (*Anthozoa*), the form of which somewhat resembles a quill, and the name SEA PEN has consequently been given to them. One species (*P. phosphorea*), which sometimes emits a brilliant phosphorescent light, is common on the English coast. It is about three inches long.

PENNISETUM, *pen-ni-se'-tum* (Lat., *penna*, feather; *seta*, bristle).—A genus of grasses. The grains of the species *P. dichotomum* are known in some parts of Western Africa as *Rasheia*. They are used there as food. In Egypt and Arabia, this grass is employed for thatching, and as fodder for camels.

PENNYROYAL. (*See* MENTHA.)

PENTACRINUS, *pen-tak'-ri-nus.*—A genus of *Echinodermata*, family *Crinoideæ*, believed to be the only living representatives of the fossil Encrinites. They consist of a long, jointed, calcareous column, from which arise at intervals whorls of arms, unbranched, and at the top is a disc branching out again into several arms. The whole of the skeleton is covered with a fleshy substance. The *Medusa's Head* is a popular name for one of the best known species. It is very rare, being only found at considerable depth in the West Indian seas. (*See* CRINOIDEÆ.)

PENTADESMA, *pen-ta-des'-ma.*—A genus of tree of the natural order *Guttiferæ.* The fruit of *P. butyracea*, when cut, yields a fatty matter; hence the plant is called the butter and tallow-tree of Sierra Leone.

PENTAGON, *pen'-ta-gon* (Gr., *pente*, five; *gonia*, an angle).—A plane figure having five angles, or contained in five sides. It is a *regular* pentagon when the sides and angles are equal, and can consequently be described in a circle.

PENUMBRA, *pe-num'-bra* (Lat. *pene*-almost; *umbra*, a shade).—The partial shade or obscurity observed on the margin of the perfect shade in an eclipse. Round each of the larger black spots on the sun's surface there is almost always seen an extensive zone of a less dark tint, the contours of which are well-defined, like those of the dark spot. This zone is also called penumbra.

PEPERINO, *pep-er-e'-no.*—A term borrowed from the Italian, and used by some geologists to denote the brown volcanic tuffs derived from augitic rocks, as distinct from the ordinary tufas.

PEPPER, *pep'-per.*—A genus of plants (*Piper*) of the natural order *Piperaceæ.* Common, or black pepper (*P. nigrum*), is a native of India, but is now cultivated in many parts of the world in the tropical region. It is a struggling climbing shrub, 10 or 12 feet in height, with spongy stem and broad oval leaves. The fruit, of a bright red colour when ripe, is about the size of a pea. The plant, which while growing is supported on poles or small trees, planted for the purpose, and is propagated by cuttings, comes into bearing about three years after it is planted, and yields two crops annually for about 12 years. The berries are dried, which causes them to be black and wrinkled, and are then ready for use. To produce white pepper, the dried berry is soaked in water, and the skin and fleshy part of the fruit removed by rubbing. Sometimes it is afterwards bleached with chlorine to improve its appearance. Black pepper is more pungent than white, the constituents of the spice being more abundant in the outer part of the berry than in the seed. This pungency depends on the presence of resin and volatile acid, and there is also a crystalline substance known as piperin. Two species, *Chavica Roxburghii*, cultivated in Bengal, and *C. officinarum*, grown in the Dutch East Indian colonies, are known in medicine as Long Pepper. The berries grow on long spikes, and as they ripen, become a compact mass. They are used for pickling and other culinary purposes. *C. Roxburghii* is known in India as *pippul*, and the root and part of the stem are used in India as a stimulant medicine, being sold in the bazaars as *pippula moola*.

Pepper-root.—A perennial herbaceous plant (*Dentaria diphylla*) of the natural order *Cruciferæ.* The root, used as a condiment, has a pungent flavour, like that of mustard. It is a native of North America.

PEPPERMINT. (*See* MENTHA.)

PEPSINE, *pep'-sin* (Gr., *pepto*, I digest).—A peculiar albuminoid body existing in the gastric juice, to which, in conjunction with the free acid, the solvent powers of that fluid seem owing. It has been extracted in large quantities from the gastric juice of the calf, sheep, and pig, and used in medicine as a digestive, very commonly in the form of pepsine wine, of which a teaspoonful is the ordinary dose.

PERCH, *pertsh* (Fr., *perche*, Lat., *perca*).—An acanthopterous fish (*Perca fluviatilis*) belonging to the family *Percidæ.* It is one of the most common and beautiful of our fresh-water fish. The upper part of the body is of a greenish-brown subsiding into golden yellow below, the sides ornamented with dark transverse bands, the irides golden, the dorsal and pectoral fins pale brown, and the anal and caudal fins bright vermillion. The perch was known to the Greeks, as Aristotle has described its habits. In England, it is found in nearly every river and lake, and it is common in the temperate parts of Europe. It varies in weight from half a pound up to three pounds, although several have been taken over the latter weight.

PERCH.—A measure of length. (*See* ROD.)

PERCHLORIC ACID. (*See* CHLORINE.)

PERCUSSION, *per-kush'-yun* (Lat., *percussio*, a blow).—In Medicine, percussion means gently striking a part of the body in order to determine by the sound the condition of the subjacent organs. This mode of discovering disease was invented by Avenbrugger, a German, in the middle of the last century, and was subsequently brought into notice by Corvisart. Some nicety is necessary in the manner of striking the chest, so as to properly elicit the sounds, and various contrivances have been recommended for that purpose; but we believe that none of them are preferable to the fingers when properly used. One or two fingers of the left hand are to be laid flat on the part to be examined, and to be struck lightly, but rather smartly, with the ends of the three first fingers of the right hand, set close together, on the same level. It is of consequence to compare the sounds given out by one side of the chest with those given out by the same part on the other; and care should be taken that the blows are always given with the same amount of force, and that they fall perpendicularly on the surface of the organ.

PEREGRINE FALCON, *per'-e-green.*—A bird (*Falco peregrinus*) found in almost every part of the world. The female is the *Falcon* of the old sport of Falconry, and the male bird is the *Tercel*. The former is larger than the latter, being about 18 inches in length from the tip of the tail to the end of the bill, while the male bird is only about 15 inches. The back, wings, and tail of both sexes are ashen-gray, and the head and back of neck nearly black, while the front of neck, the breast, and belly, nearly white, with dark-brown transverse bars. Both birds have great powers of flight, having very long wings, and they can easily maintain a speed of 100 miles per hour. Its swoop downwards on its prey is remarkably rapid. It forms its nest on the ledges of high rocks, and lays from two to four eggs. (*See* HAWKING.)

PERENNIAL, *pe-ren'-ne-al.*—A Botanical term designating plants which subsist for a number of years; but it is generally limited in its application to herbaceous plants, the roots of which live while the stems die away at the end of the summer. Some plants which are perennials in warm climates are only annuals in cold regions.

PERIANTH, *per'-i-anth* (Gr., *peri*, around; *anthos*, a flower).—The floral envelope of those plants in which the calyx and corolla are not readily distinguished. It is often very beautiful, as in tulips, crocuses, lilies, and other well-known flowers.

PERICARDITIS AND PERICARDIUM, *pe-ri-kar'-di-tis, pe-ri-kar'-de-um.* (*See* HEART.)

PERICARP, *pe'-ri-karp.* (*See* FRUIT.)

PERIGEE, *per'-i-jee* (Gr., *peri*, about; *gē*, the earth).—That part of the moon's orbit which is nearest the earth. (*See* APOGEE.)

PERIHELION, *pe-ri-he'-le-on* (Gr., *peri*, about; *helios*, the sun).—The extremity of the major axis of a planet's orbit which is nearest the sun is called the *perihelion;* the opposite extremity bears the name of the *aphelion*.

PERIMETER, *pe-rim'-e-ter* (Gr., *peri*, about; *metron*, measure).—The extent which bounds a figure or body, whether rectilinear or otherwise. In circular figures, the term *circumference* is used instead of *perimeter*.

PERIODICITY, *per-ri-od-is'-i-te.*—A term applied by physiologists to the tendency manifested by various phenomena (both of health and disease) in living animals to recur after equal, or nearly equal, intervals of time. Many, but not remarkable, attempts have been made to ascertain the cause of this regular recurrence, which is a morbid condition of the body, especially noticeable in cases of ague, epilepsy, and spasmodic seizure.

PERIOSTEUM, *per-e-os'-te-um* (Gr., *peri*, and *osteon*, a bone).—The membrane that covers the bone. (*See* BONE, ANATOMY.) Inflammation of the Periosteum is known as *periostitis.*

PERIPNEUMONIA, *per-i-neu-mo'-ne-a.*—An inflammation of the membrane which surrounds the lungs, very prevalent among horses, oxen, and antelopes in South Africa.

PERISTALTIC MOTION, *per-is-tal'-tik* (Gr., clasping and compressing).—The peculiar action of the muscular coat of the intestines, by which the contents are carried onwards and finally evacuated.

PERITONEUM, *pe-ri-to-ne'-um* (Gr., *peri teino*, I stretch round).—The thin serous membrane lining the abdominal cavity, and enveloping the contained organs, so as to keep them in their proper places. Like the other serous membranes, it is an enclosed sac, covering, but not containing, the organs in its cavity, with its internal surface smooth and shining, and moistened by a serous fluid for aiding the natural movements of the organs upon each other. The folds which surround the small intestines constitute the mesentery; that which hangs down from the stomach, and is then reflected upwards and backwards to the colon, is the omentum. The peritoneum is liable to inflammation exceedingly painful and dangerous, from its extent and connection with important organs, known as *peritonitis*, which may exist either as an acute or chronic disease.

PERIWINKLE, *per-e-win'-kl* (Sax., *peruince*).—A marine animal (*Littorina*), belonging to the *Littorinidæ*, a family of gasteropodous molluscs living in the sea or in brackish water. The shell of the periwinkle is not smooth, but is solid, and its whorls are more or less flattened instead of being rounded. Great quantities of the common periwinkle, a snail-like mollusc abundant on the rocky parts of the British coast, are eaten.

In Botany, the periwinkle (*Vinca*) is a genus of plants of the natural order *Apocynaceæ*. Two species, the lesser and greater (*V. minor* and *V. major*) are known in this country, the former most abundant, growing in thickets and woods. It is a half-shrubby plant, with trailing stems, and pale blue or white or red flowers. The flowers of the other species are large. The herbaceous periwinkle, a native of Hungary, the yellow, of North America, and the rose-coloured, from Madagascar, are attractive varieties. The periwinkle has been long known in this country, and is mentioned by Chaucer.

PERMIAN GROUP, *per'-me-an.*—In Geology, the lower division of the New Red Sandstone rocks, and known also as the Magnesian Limestone or Dias group. In 1841, Mr. Murchison gave the name of Permian, because he found the rocks largely developed in that portion of Russia which composed the ancient kingdom of Permia. The group is not remarkable for organic remains, although bones and teeth of Saurians and family of labyrinthodont reptiles are found.

PERMUTATIONS, *per-mu-tai'-shunz* (from *per*, and *muto*, I change).—The different orders which can be formed out of any number of things, with regard to position, when all are taken at once. If we want to find the different number of changes which may be rung upon seven bells, taken all together, we multiply the order of bells into one another, and the changes will be equal to—$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 = 5{,}040$.

PERN.—The honey-buzzard. (*See* BUZZARD.)

PERNAMBUCO WOOD. (*See* CESALPINIA.)

PERPENDICULAR, *per-pen-dik'-u-lar* (Lat., *perpendicularis*).—A line extending in a right line from the centre of the earth towards any point above, or at right angles with the plane of the horizon, in opposition to *horizontal*, which means being parallel with the plane of the horizon. Perpendicular is synonymous with vertical. A perpendicular, in geometry, means any line drawn at right angles to another, which is termed the *base*.

PERPETUAL MOTION. (*See* MOTION, LAWS OF.)

PERRY. (*See* PEAR.)

PERSEA, *per'-se-a*.—A genus of the natural order *Lauraceæ*. The fruit of *P. gratissima* forms the much-esteemed avocado pear of the West Indies. *P. indica*, a native of Madeira, yields timber somewhat resembling mahogany.

PERSPIRATION, *per-spe-rai'-shun* (Lat., *perpsiratio*, from *perspiro*, I breathe through).—That watery vapour which is constantly passing off through the pores of the skin, and is distinguished into insensible and sensible, the former passing off in the form of invisible vapour, the latter being more profuse, and collecting in drops on the surface. In either form it is the same, consisting chiefly of water, with a small quantity of acetic acid, of muriate of soda and potash, a small quantity of earthy phosphate, an atom of oxide of iron, and a trace of animal matter. The secreting organs are the extremities of the cutaneous arteries. It is calculated that about three pounds of water are daily conveyed to the surface of the body as insensible perspiration, and this quantity is very considerably increased during violent exercise or in hot weather. It is more or less copious in different individuals, and its quantity is perceptibly in the inverse ratio of that of the urine. More is produced during digestion than during repose. Its use is to eliminate superfluous and noxious matters from the blood, and to moisten the external surface of the body. Its expulsion from the system is very important, for whenever it is diminished or sus pended, serious derangements may follow.

PERTURBATIONS, *per-tur-bai'-shuns* (Lat., *perturbatio*, a disturbance).—Deviations of the planets from their regular course, produced by their mutual gravitation. The law of universal gravitation, discovered by Newton, threw great light on this subject. It was shown by him that all bodies are attracted towards each other; hence, every planet not only gravitates towards the sun, but also towards every other planet; the moon not only towards the earth, but more particularly towards the sun, and even towards Venus and Jupiter. The regular course of the planets in elliptical orbits is effected by the attraction of the sun; the course of the moon by the attraction of the earth; perturbations must, therefore, occur in the motion of the moon and planets, if they are also acted on by other bodies. Part of these deviations was explained and determined by Newton; as, for instance, the procession of the equinoxes and the nutation of the earth's axis. Many articles, however, which require the infinitesimal calculus for their solution, are left undetermined. Laplace afterwards found a formula which was universally applicable, and published it in his *Mécanique Céleste*.

PERUVIAN BARKS. (*See* CINCHONA.)

PESTILENCE, *pes'-ti-lense*. (*See* PLAGUE.)

PETAL, *pet'-al* (Gr., *petalon*, a leaf).—A modified leaf, forming part of the corolla. Petals are frequently of the richest colour, by which character, and by their more delicate nature, they may be usually distinguished from the sepals, or parts of the calyx.

PETALISM, *pet'-al-ism*.—A mode of deciding upon the guilt of citizens of Syracuse, in use about the 5th century B.C. The name was written on a leaf (generally of an olive); and if guilt was established by the votes of the majority, the sentence was usually banishment. (*See* OSTRACISM.)

PETALOIDEÆ, *pet-al-oi'-de-e*.—A sub-class of *Monocotyledones* (known as *Floridæ*), characterized by permanent leaves with parallel venation; verticillate floral envelopes (sometimes absent), usually coloured, rarely scaly. Thirty-seven natural orders are included by Professor Bentley in this sub-class; namely:—1. *Epigynæ*,—Orchidaceæ (the Orchis order), Apostasiaceæ, Burmanniaceæ, Zingiberaceæ (the Ginger order). Marantaceæ (the Arrowroot order), Musaceæ (the Banana or Plantain order), Iridaceæ (the Iris order), Amaryllidaceæ (the Amaryllis order), Hypoxidaceæ, Hæmodoraceæ, Taccaceæ, Bromeliaceæ (the Pine-apple order). 2. *Hypogynæ*.—Liliaceæ (the Lily order), Melanthaceæ or Colchicaceæ (the Colchicum order), Gilliesiaceæ, Pontederaceæ, Mayaceæ, Commelynaceæ, Xyridaceæ, Philydraceæ, Juncaceæ (the Rush order), Orontiaceæ (the Sweet-flag order), Palmaceæ (the Palms), Juncaginaceæ, Alismaceæ, Butomaceæ (the Flowering-rush order). 3. *Diclines*.—Pandanaceæ (the Screw-pine order), Typhaceæ (the Bulrush order), Araceæ (the Arum order), Pistiaceæ or Lemnaceæ (the Duckweed order), Naiadaceæ (the Pondweed order), Zosteraceæ (the Sea-wrack order), Triuridaceæ, Hydrocharidaceæ (the Frogbit order), Restiaceæ, Eriocaulaceæ, Desvauxiaceæ.

PETCHARY, *petch'-a-re*.—The popular name of many species of birds of the genus *Tyrannus*. The peculiar shrieking cry of the Gray Petchary (*T. Dominincensis*) probably gave rise to the name. This bird is migratory, spending the spring and summer in the West Indian Islands, and visits the hottest parts of the American Continent in the winter months. It is 9 or 10 inches long, bold and strong, and feeds on insects and berries, and sometimes on humming-birds. It is considered a delicacy for the table. The Common Petchary (*T. caudifasciatus*) of the West Indies, also furnishes a favourite dish.

PETECHIÆ, *pe-te'-ke-e*. — Crimson or purple spots which appear beneath the skin, resulting from minute extravasation of blood. They indicate a changed condition of the blood, and are in many cases symptoms of serious diseases.

PETIVERIACEÆ, *pet-e-ve-re-ai'-se-e*.—A small natural order of *Dicotyledones*, sub-class *Monochlamydeæ*. The plants are natives of tropical America; most of them are acrid, and some have a strong alliaceous odour. *P. alliacea* is reputed sudorific and emmenogoge, and its root is much used in the West Indies as a remedy for toothache.

PETREL, *pe'-trel*.—A bird placed by some naturalists among the *Laridæ;* by others considered as forming a separate family, *Procellaridæ.* The petrels belong, as do the shearwaters and fulmars, to the genus *Thalassidroma* (Gr., "sea-runner"), a name descriptive of the manner in which they appear to run on the waves of the sea. The petrel (diminutive of Peter, the apostle who walked on the water) is one of the smallest web-footed birds known, being only six inches in length. The Stormy Petrel, which is better known to mariners under the title of "Mother Carey's chicken," has a black bill; the irides are dark brown; the head, neck, back, wings, and tail, sooty black; outer edge of tertial feathers, white; chin, throat, breast, and under surface of the body, black; sides of the vent, white; and legs, toes, and membranes, black. The flight resembles that of a swallow. It breeds on the Lowe Isles, Iceland, and the Scilly Isles, and roves at large over the greater portion of the Atlantic. Its food consists of small fish, and those crustacea and mollusca which are found in the floating sea-weed, which may be seen over many parts of the ocean. It often keeps in company with a ship for days, not only for shelter, but for scraps of provisions thrown overboard. Sailors superstitiously believe that when the Mother Carey's chickens are seen flying about, it is a sign that a storm is coming. Besides the stormy petrel, which has been just described, there are other varieties: as Bulwer's petrel (*Thalassidroma Bulwerii*), a native of Madeira, and about ten inches long; Wilson's petrel (*T. Wilsoni*), which breeds about Nova Scotia (its length is about seven and a half inches); and the forked-tailed petrel (*T. eachii*).

PETRIFACTION, *pet-re-fak'-shun* (Lat., *petra*, a stone; *facio*, I make).—A general term, which is used to designate animal or vegetable substances which have been converted into stone. Petrifactions are found in the aqueous or stratified rocks, and the appearance presented by organic remains or fossils is very various. In some cases, they are found in nearly as perfect a state as when first deposited; in others, the organic matter is more or less destroyed, and has been replaced by a stony matter; and when this has been completely effected, a genuine petrifaction is the result. (*See* FOSSIL and GEOLOGY.)

PETROICA, *pe-tro-i'-ka.*—A genus of Australian birds, the "robin" of the colonists, belonging to the family *Sylviadæ*, and nearly allied to the redbreast, but unlike in plumage. The male of *P. multicolor*, a species abundant in the southern part of Australia, has a light scarlet breast; black head, throat, and back; white forehead, and white bands on the wings. The female is brown, with a red breast.

PETROLOGY, *pe-tro'-lo-je.*—The study of rocks, their forms, masses, and mutual relations irrespective of their geological characteristics.

PETROMYZON, *pe-tro-mi'-zon.* (*See* LAMPREY.)

PETROSELINUM, *pe-tro-se-li'-num* (Gr., *petros*, a rock; *selinon*, parsley; in allusion to the habitation of the species).—A genus of the natural order *Umbelliferæ.* The species, *P. sativum*, is the common parsley of our gardens, an herb which plays an important part in English cookery. The delicate green of its curled leaves has made it the favourite herb for garnishing and ornamenting dishes; and it also possesses nutritious and stimulating properties, due to an essential oil present in every part of the plant. It contains also a gelatinous substance, *apiine;* and the bruised leaves are sometimes used as a poultice. The seeds are a deadly poison to many birds; and, when powdered, are used for destroying lice.

PETUNIA, *pe-tu'-ne-a.* (Brazil., *petun*).—A genus of herbaceous plants, natives of the warmer parts of America, and belonging to the natural order *Solanaceæ.* They bear a general resemblance to tobacco, but having beautiful flowers, which make the cultivated varieties very ornamental. They are perennial, tall, straggling plants, which may be trained over trellis-work with good effect. They were introduced into this country in 1825.

PETUNTZE, *pe-tunt'-ze.*—A white earth, composed, it is supposed, of undecomposed felspar, used in a fused condition by the Chinese for the purpose of glazing porcelain.

PETWORTH, OR SUSSEX MARBLE.—A thin layer of limestone, composed of freshwater shells, used in some ecclesiastical edifices, especially in the cathedrals of Canterbury and Chichester, for ornamental purposes.

PHAETON. (*See* TROPIC BIRD.)

PHAGEDÆNIC, *fadj-e-den'-ik* (Gr., *phago*, I eat).—A term applied to ulcers that eat or destroy very rapidly. A very bad form is known as sloughing phagedæna, or hospital gangrene.

PHALACROCORAX, *fa-la-kro'-ko-rax.*—(*See* CORMORANT.)

PHALÆNA, *fa-le'-na.* (*See* MOTH.)

PHALANGER, *fal'-an-jer.*—A genus of marsupial quadrupeds (*Phalangista*), mostly found in Australia and the adjacent islands. The head and ears are short, the fur woolly, and the tail long and prehensile. The fore-paws are strong, and are used for conveying food to the mouth. The food is chiefly insects, various small animals, eggs, and fruit. The Sooty Phalanger, or Tapoa (*P. fuliginosa*), a Tasmanian species, has a fine black fur, tinged with chestnut, which is much sought after, and a bushy tail. An Australian species (*V. vulpina*), known as the Vulpine Phalanger, or Vulpine Opossum, is about 25 inches long in body, with a bushy tail about 15 inches long. The colour is grayish-yellow, and tawny on the lower parts. The Flying Phalanger is an allied species. (*See* FLYING SQUIRREL.)

PHALANGES, *fal-an'-jeez* (Gr., a batallion).—The name given to the small bones of the fingers and toes. (*See* FOOT, HAND.)

PHALANGIDÆ, *fal-an'-ji-dæ.*—A family of *Arachnidæ*, resembling spiders in general appearance, and having very long, slender legs. They appear in great numbers in fields during hay and corn harvests, and are known to the labourers as "harvest-men."

PHALARIS, *fal'-a-ris* (Gr., *phalaros*, brilliant).—A genus of grasses. *P. Canariensis*, Canary grass, is cultivated largely for its grain, which is employed as food for song-birds, under the name of canary-seed. Its straw is also valued as fodder for horses.

PHALAROPE, *fal'-a-rope.*—A genus of birds (*Phalaropus*), of the family *Lobipedidæ.* In some respects they resemble the sandpipers. but are more aquatic in their habits. The Gray

Phalarope (*P. lobatus*) is a native of the Arctic regions, but migrates southward on the approach of winter, and is often seen in this country. It is a beautiful bird, about eight inches long, with a short tail. In summer, the upper parts are of a black, white, and yellow colour, with a bright chestnut colour on the breast and under parts; but in winter the colour is of a nearly uniform gray. The Red-necked Phalarope (*P. hyperboreus*), is a smaller bird, and breeds in some of the Scottish islands, as well as in more northern regions.

PHALLUS.—A genus of fungi, belonging to the *Gasteromycetes*, egg-shaped at first, but producing a stem, the receptacle which produces the spores. A common British species is popularly known as the stinkhorn, from the abominable odour it emits.

PHANEROGAMIA, *fan-e-ro-gai'-me-a* (Gr., *phaneros*, manifest; *gamos*, marriage).—The name given to the great sub-kingdom which includes plants having evident flowers, and being propagated by seeds containing an embryo with one or more cotyledons. The phanerogamia are also called flowering or cotyledonous plants.

PHARYNGOBRANCHII, *far-ing-o-bran'-ke-i.*—Fishes of a very low organization, belonging to the sub-order *Dermopteræ*. They have respiratory processes projecting from above the pharynx into the mouth. There are very few species. (*See* LANCELET.)

PHARYNX, *far'-inks* (Gr., the throat; from *phero*, I convey, because it conveys food into the stomach).—The muscular funnel-shaped bag at the back part of the mouth, which receives the masticated food, and conveys it to the œsophagus. It is broadest about the middle, being constricted at either end, more particularly below, where it terminates in the œsophagus. *Pharyngitis* is inflammation of the pharynx; *pharyngotomy*, the operation of cutting into the pharynx for the purpose of extracting any foreign body. The pharynx is usually the seat of diphtheria.

PHASCOGALÉ, *fas-ko'-ga-le.*—A genus of marsupalian animals. The Tapoa Tafa (*P. penicillata*) is well known in most parts of Australia. It is about six inches in length, with long, soft hair and a long tufted tail. It lives chiefly in the hollows of trees, and feeds on small animals. It is very bold, and visits the poultry-yards and larders of the colonists.

PHASEOLUS, *fa-ze'-o-lus* (Lat., *phaselus*, a little boat, from the form of the pods).—A genus of the natural order *Leguminosæ*. The species are commonly known as kidney-beans, scarlet-runners, and haricots. Most of these plants are climbers; the few which do not climb are called dwarf-beans. The roots of the scarlet-runner (*P. multiflorus*) are poisonous.

PHASES, *fai'-zez* (Gr., *phasis*, appearance).—A term used in Astronomy to signify the various appearances of the moon and the superior planets at different ages; also the appearance of the sun or moon during an eclipse.

PHASIANIDÆ, *fai-si-an'-i-de.*—A family of gallinaceous birds, including pheasants, fowls, and similar birds. Some naturalists include peacocks and turkeys in the family.

PHASMIDÆ, *fas'-mi-de* (Gr., *phasma*, a spectre).—A family of orthopterous insects, allied to *Mantidæ*, but different in the fore-legs, which are used for locomotion, not for combat or taking hold of foods. (*See* LEAF INSECTS, SPECTRE INSECTS, WALKING-STICKS.)

PHEASANT, *fez'-zant* (Lat., *phasianus*; Fr., *faisan*).—The pheasant (*Phasianus*) was originally a native of the banks of the Phasis, a river of Colchis, in Asia Minor; whence it was brought by the Greeks into Europe, where it speedily began to be held in high request, both for the beauty of its plumage and its succulent qualities as an article of food for the table. The pheasant is extensively diffused throughout England, and has become naturalized even so far north as Northumberland. Their extension and preservation is due to the love of sport. They are carefully protected in order that a considerable number of them may be afterwards killed. The favourite resorts of pheasants are woods that are thick at the bottom, with long grass kept up by brambles and bushes, and thick plantations, or moist grounds, and marshy islands overgrown with rushes and osiers. They can seldom be induced to remain for any length of time on any ground bare of shelter, as wood and water are indispensable to them, on account of their habits. The females begin to lay their eggs in April, and hatch them by the end of May. They lay generally from ten to fourteen, and the eggs are of a uniform olive-brown colour, and nearly spherical in shape. The pheasant chiefly feeds, in a wild state, on grain, seeds, green leaves, and insects, as well as some berries, of which they are fond, as blackberries, &c. They seldom use their wings, except to get away from an enemy, but generally run along; and the speed with which they get over the ground is somewhat surprising. The ordinary weight of a pheasant is from two pounds to two pounds and a half, although many of heavier weight have been killed. The whole length of the male is about three feet, while that of the female is about two, although the length greatly depends on that of the middle feathers of the tail, which often exceed two feet. The colour of the adult male is much varied: the ears are surrounded by a naked skin of bright scarlet, speckled with bluish-black; the irides hazel; the head and neck steel-blue, reflecting brown, green, and purple in different lights; the ear-coverts dark brown; upper part of back orange-red tipped with black; tail-feathers very long, of pale yellow-brown colour, with narrow transverse bands of black, about an inch apart; the breast and under surface of the body golden-red; and, finally, the legs, toes, and claws of a brownish lead-colour. The females have a dull brownish earth-colour plumage, and sink far below the male in appearance; but it is to this that they owe their escape from the sportsman, whence they can rear and bring up their broods in safety, without running those risks which the male has to undergo. When past the age of reproduction, they have sometimes assumed the plumage of the male. The pheasant has a marked inclination to breed with other gallinaceous birds, as the common fowl of our poultry-yard, the turkey, &c.

PHEASANT-SHELL.—A genus of gasteropodous molluscs (*Phasianella*), of the family *Turbinidæ*. The shells are very beautiful, and are found in great numbers on the coast of Australia.

PHILADELPHACEÆ, *fil-a-del-fai'-se-e* (from *philadelphus*, one of the genus).—The *Syringa* family, a natural order of *Dicotyledones*, sub-class *Calyciflorœ*. There are four genera and 25 species, natives of the south of Europe, North America, Japan, and India.

PHILADELPHUS, *fil-a-del'-fus* (Gr., *phileo*, I love; *adelphos*, a brother, because it attaches itself to whatever is near, by its roughness).—The *Syringa*, the typical genus of the natural order *Philadelphaceœ*. (*See* SYRINGA.)

PHILESIACEÆ, *fil-e-se-ai'-se-e*.—The *Philesia* family, a small natural order of twining shrubs, natives of Peru. This order belongs to the class *Monocotyledones*, sub-class *Dictyogenœ*.

PHILYDRACEÆ, *fil-e-drai'-se-e* (Gr., *phileo*, I love; *udor*, water).—The Water-wort family, a small natural order of *Monocotyledones*, sub-class *Petaloideœ*, consisting of herbs with fibrous roots, sword-like sheathing leaves, and flowers surrounded by spathaceous persistent bracts. They are natives of China and Tasmania.

PHLEBITIS, *fle-bi'-tis* (Gr., *phlebs*, a vein).—A medical term used to indicate inflammation of the veins, frequently following wounds, and sometimes the result of very slight injuries.

PHLEBOLITES, *fle'-bo-lites* (Gr., *phlebs*, a vein, *bithas*, a stone).—Calcareous concretions in veins, seldom detected till after death, but in some cases causing external tumours.

PHLEBOTOMY, OR VENESECTION, *fle-bot'-o-me, ve-ne-sek'-shun* (Gr., *phlebs*, a vein, and *temno*, I cut).—The opening of a vein for taking away blood. (*See* BLEEDING.)

PHLEGMASIA ALBA DOLENS, *flem'-a-se-a al'-ba do'-lens*.—An affection of the thigh and leg occasionally experienced by women after childbed, and originating in inflammation of the veins of the womb. Unmarried women and males are, however, sometimes subject to it. The popular name is "milk leg," from a notion that it was caused in women by an irregular secretion of the milk, which, leaving the breast, settled in the leg. The limb swells to nearly double its usual size, and great pain is felt. Warm fomentations, and the application of soap liniment and laudanum, generally cause the acute symptoms to disappear in about a fortnight; but the enlargement of the limb frequently continues for a long period, sometimes for life.

PHLEUM, *fle'-um*. (*See* TIMOTHY GRASS.)

PHLOGISTON, *flo-jis'-ton* (Gr., *phlogizo*, I burn).—The supposed combustible matter of Stahl, by means of which he attempted to explain the phenomena of combustion. It was pure fire, which, being combined with certain bodies, rendered them combustible. The existence of oxygen was not then discovered, on the absorption of which combustion is now known to depend.

PHLOX, *flox*.—A genus of plants of the natural order *Polemoniaceœ*, perennial plants, mostly natives of North America. There are many species, and a large number are cultivated in our gardens, florists having succeeded in producing some fine varieties.

PHOBEROS, *fo'-be-ros*.—A genus of trees of the natural order *Bixaceœ*, growing in South Africa. The timber is hard and fine-grained, and used by cabinet-makers, mill-wrights and waggon-makers.

PHOCÆNA, *fo-se'-na*. (*See* PORPOISE.)

PHOCIDÆ, *fo'-si-de*. (*See* SEAL.)

PHŒNIX (Greek name of the date).—A genus of palms. *P. dactylifera* is the date-palm, one of the most important food-bearing plants. In some parts of Africa and Arabia, dates may be said to form the daily bread of the inhabitants. They are imported into this country, and are here used as an article for the dessert. This tree is the palm commonly referred to in Scripture. Sugar and toddy are prepared from its juice. *P. sylvestris*, the wild date-palm, is the plant from which most of the palm-sugar used in the East is obtained. It is a native of India, where it is said 130,000,000 lbs. of sugar are obtained from it annually. *P. farinifera* yields an inferior kind of sago, used as food in some parts of India.

Phœnix.—One of the southern constellations.

PHORMIUM, *for'-me-um* (Gr., *phormos*, a basket, alluding to the use made of the plant in its native country).—A genus of the natural order *Liliaceœ*. *P. tenax* is a native of New Zealand. The fibre obtained from its leaves has great strength, and is much used for cordage, and, to a limited extent, for linen. It is called New Zealand flax.

PHOSPHATES, *fos'-fates*.—Salts formed by combination of phosphoric acid with salifiable bases. They are important constituents in the chemistry of the animal body. *Phosphate of soda* occurs in all the fluids and soft tissues of the body, especially in the bile and urine. *Phosphate of lime* appears in two forms, neutral, or basic, and acid. The former is most abundant in the bones and the enamel of the teeth, in the latter to the extent of 80 or 90 per cent., and if deficient in the system, the bones lose their firmness. A portion of this form of the phosphate is taken with the food, but part of it is formed by the action of carbonate of lime on the phosphoric acid produced by the disintegration of the brain and other phosphorus-containing issues. The acid phosphate of lime, occasionally found in the urine, is of very little importance. *Phosphates of ammonia and magnesia* occur in prismatic crystals in alkaline urine.

Phosphatic Diathesis.—The condition of the body in which there is a tendency to the deposit of white gravel in the urine. It is caused by deficient acidity.

PHOSPHORESCENCE, *fos-for-es'-ens* (Gr., *phos*, light; *phero*, I bring).—A property which certain bodies possess of becoming luminous under certain conditions, without undergoing combustion. This luminosity is usually faint, and emitted continuously rather than by flashes, for a period varying from a small fraction of a second to several minutes, or even hours. Phosphorescence is observed not only among organized matter, living and dead, but also among a large number of mineral bodies in the solid state, after they have been exposed to extraneous sources of light. Two pieces of quartz, on being rubbed together, emit light; and a phosphorescent light is seen when two pieces of loaf-sugar are rubbed together in the dark. Nitrate of magnesia is luminous, and a variety of blende (sulphide of zinc), on being scratched with a knife, emits a fine yellow light. It has been found that the phosphorescent light of minerals has the same properties as the direct light of the sun. Amongst those mineral substances which emit light in consequence of the action of extraneous light, the most powerful is Canton's phosphorus. It is formed by mixing three parts of powdered oyster-shells with one part of sulphur, and ramming the mixture into a crucible, igniting it for about half an hour. On exposure to sunlight, or to ordinary daylight, or to an electrical explosion, the bright parts will acquire the property of shining in the dark, so as to illuminate the dial of a watch, and make its figures legible. When an electric discharge is passed along the surfaces of certain bodies, or a little above them, phosphorescence is produced. Thus sulphate of barytes gives a bright green light; acetate of potash also a bright green light; and rock crystal first a red, and then a white light. Sir David Brewster found that the following fluids were phosphorescent when poured into a heated iron vessel. Albumen (white of egg), diluted with water; isinglass, in solution; saliva; soap and water; solution of rhubarb, common salt, and nitrate of potash; tallow, alcohol, and olive-oil. Several cryptogamous plants have been observed to be luminous in the dark. The *Rhizamorpha phosphorea*, found in the mines of Hesse, exhibits light when the extremities of the plant are broken. Of all luminous organisms, however, the marine animals are the most remarkable; and to them in chief is attributable the general phosphorescence of the ocean. In warm regions and more southerly latitudes, this phenomenon often attains a high degree of brilliancy and beauty. Almost all the lower forms of life in the sea, but especially the acaleptra, infusoria, polypi, and mollusca, possess the power of emitting light. The *Noctiluca scintillans*, a little creature not so large as the head of a pin, gives out a splendid radiance; and an organism of cylindrical form, the pyrosma, or "fire-dancers," emits so much light that it is possible with its help to read a book at night. Certain land insects also, such as the lightning-bug and the glow-worm, emit light. Another kind of phosphorescence is that which appears during the decomposition of animal and vegetable matter. Some kind of fish, even when quite fresh, emit a phosphorescent light when in a dark place.

PHOSPHORUS, *fos'-for-us* (Gr., *phos*, light, and *phero*, to bring).—One of the non-metallic elements found in nature only in a state of combination, chiefly in the form of phosphate of lime, which forms the principal constituent of apatite, phosphorite, coprolites, &c. It seems to be essential to the life of plants, and is found to be concentrated in their seeds. It exists in large proportions in the bodies of animals; in the blood, in the urine, in the hair, in the nervous tissues, and in the bones, of which phosphate of lime forms a large constituent. It was first discovered in urine by Brandt, in 1669. It is now, however, extracted from bones.

Oxides and Acids.—Phosphorus unites with oxygen in four proportions, forming oxide of phosphorus, hypophosphorous acid, phosphoric acid, and phosphorous acid.

Oxide of Phosphorus is an important compound, formed in a small quantity when phosphorus is burned in air.

Hypophosphorous Acid has never yet been obtained in an anhydrous form. It is procured in a hydrated condition, by boiling phosphorus with baryta and water. Hypophosphate of baryta is formed, which may be afterwards decomposed by cautiously adding sulphuric acid. Hypophosphorous acid forms an uncrystallizable syrup, with feebly-marked acid properties. It is interesting from forming a series of salts much used in medicine. A mixture of the hypophosphites of lime, soda, and iron, is known in America as "chemical food." The acid itself has a remarkable action on sulphate of copper. If an excess be added to a solution of the last-named salt and warmed to about 130° Fahr., a solid insoluble hydride of copper is precipitated.

Phosphoric Acid is produced by the rapid combustion of phosphorus in oxygen or atmospheric air. When the oxygen is perfectly dry, it is obtained as a mere white flocculent, but very deliquescent powder, hissing when thrown into water, and forming with it hydrated phosphoric acid. When once dissolved, it cannot again be deprived of its water of hydration, except it be combined with a base. There are three different hydrates of phosphoric acid, *monobasic*, *bibasic*, and *tribasic*, each of which forms separate salts with the bases. Dilute phosphoric acid is used in medicine, chiefly as an acidulated draught.

Phosphorous Acid is produced by placing sticks of phosphorus in tubes open at both ends, the lower aperture being contracted to prevent the phosphorus from falling through. A number of these tubes being placed in a funnel, the acid, which is highly deliquescent, gradually drains through into the vessel placed beneath. Phosphorous acid is obtained in a pure hydrated form by sending a stream of chlorine through a layer of phosphorus melted under water. Terchloride of phosphorus is formed, and is decomposed at once into hydrochloric and phosphorous acids. Phosphorous acid forms two classes of salts.

Chlorides of Phosphorus.—With chlorine, phosphorus forms a terchloride and a pentachloride; with iodine, a biniodide and teriodide. It also forms a compound with nitrogen, which has not been investigated. It also forms several compounds with sulphur, one of which is remarkable as containing twelve equivalents of sulphur to one of phosphorus. With methyl, ethyl, and several other bodies, phosphorus seems to play the part of nitrogen, forming with them substances analogous to the compound ammonias—ethylamine, diethylamine, &c.

PHOTOSPHERE. (*See* SUN.)

PHRAGMITES, *frag-mites'*. (*See* REED.)

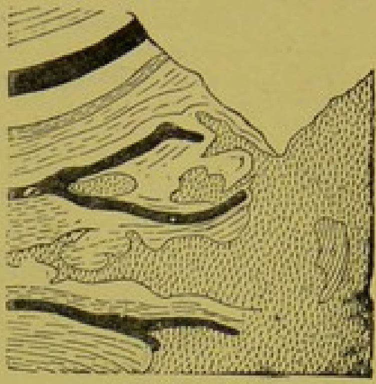
PHRENITIS, *fre-ni'-tis* (Gr., *phrenes*, from *phren*, the mind).—Inflammation of the brain, or any of its membranes. (*See* BRAIN, DISEASES OF THE.) The term phren or phrenic was anciently applied to the diaphragm, as being the supposed seat of the soul. From the same root we have the term *phrensy*.

PHTHISIS, OR CONSUMPTION, *ti'-sis* (Gr., *phthio*, I consume).—A disease which is prevalent and fatal in this country, as in most others, though, perhaps, there is no country where its ravages are so great as in England. It is the result of the formation and development of tubercles in the lungs. These first appear in the form of small, gray, semi-transparent granulations, which gradually enlarge and become opaque, and after a time empty themselves into the bronchial tubes, and thus gradually destroy the substance of the lung. The causes of this disease are divided into remote and exciting; of the former, the most important is hereditary predisposition. It is not, however, an actual cause of the disease, and hence there are many cases in which the children of consumptive parents do not fall a prey to this disease; but it renders those who are in that condition much more liable to be affected by the exciting causes. Whatever weakens the strength of the system, or interferes with the oxygenation of the blood, tends to the production of this disease. Hence living in bad air, insufficient and unwholesome food, and sedentary pursuits, tend to it. Among the more exciting causes are exposure to cold or damp, especially after the body has been previously heated, intemperance of any kind, profuse evacuations, and exposure to the reception of dust into the lungs, as in the case of certain artificers, needle-pointers, stone-cutters, and the like. The earliest symptom of consumption that usually manifests itself is a short, dry cough, exciting no particular attention, being attributed to a slight cold. It, however, continues, and after a time increases in frequency. The breathing is more easily hurried by bodily motion, and the pulse becomes more frequent, particularly after meals and towards evening. Towards evening, there is also frequently experienced a slight degree of chilliness, followed by heat and nocturnal perspirations. The patient becomes languid and indolent, and gradually loses strength. After a time, the cough becomes more frequent, and is particularly troublesome during the night, accompanied by an expectoration of a clear, frothy substance, which afterwards becomes more copious, viscid, and opaque and is most considerable in the morning; the *sputa* are often tinged with blood, or hæmoptysis occurs in a more marked form, and to a greater extent. As the disease advances, the breathing and pulse become more hurried, the fever is greater, and the perspirations more regular and profuse. The emaciation and weakness go on increasing, a pain is felt in some part of the thorax, which is increased by coughing, and sometimes becomes so acute as to prevent the patient from lying on the affected side. All the symptoms increase towards evening: the face is flushed, the palms of the hands and soles of the feet are affected with a burning heat, the feet and ankles begin to swell, and in the last stage of consumption there is nearly always profuse diarrhœa. The emaciation is extreme; the countenance assumes a cadaverous appearance, the cheeks are prominent, the eyes hollow and languid. Usually the appetite remains entire till the end, and the patient flatters himself with the hope of a speedy recovery, often vainly forming distant projects of interest or amusement, when death puts a period to his existence. Tubercular deposits are also usually found in other organs of the body; the liver is enlarged and changes in appearance, and ulcerations occur in the intestines, the larynx, and trachea. These are so frequent and uniform as to lead to the belief that they form part of the disease. The constitutions that are most liable to its attack are generally characterized either by a fair, delicate, rosy complexion, fair hair, clear skin, and great sensibility, or by dark complexion, large features, thick and sallow skin, and heavy general expression. The development of the disease is preceded by a peculiar form of indigestion, known as "strumous dyspepsia." It is specially characterized by a dislike of fatty food, sometimes also of sugar and alcohol, and is accompanied with heartburn and acid eructations after taking food. The treatment of this disease is of two kinds—the one directed to strengthening the system for its prevention in those predisposed to it, or overcoming it in its incipient stages; the other to arrresting its progress after the tubercles have manifested themselves. The former class comprises a proper attention to the digestive organs, with wholesome diet, exercise in the open air, regular habits, attention to the skin, and, if necessary, change of air. The diet should be nutritious, but not stimulant, and the exercise not violent or too prolonged. Sea voyages, or residence at the sea-side, are generally found to be very beneficial; and, as a general rule, those places that are least subject to variations of temperature are recommended. Of the more directly curative remedies, unquestionably the most valuable is cod-liver oil. It should be taken in small quantities at first, probably a tea-spoonful three times a day, during, or immediately after meals; and the effect is greatly to improve the appearance of the patient, and to counteract the progress of the disease. If taken early, the tuberculous deposit may be arrested, and the patient restored to a state of health; and even where this is not the case, the progress of the disease will at least be retarded. Tonic medicines, such as bark, sarsaparilla, iron, and iodine, are also very beneficial in the treatment of phthisis; at least in those cases where inflammation or much febrile excitement does not exist. Where inflammation already exists, it may be subdued, by small bleedings repeated at intervals of a few days or a week, by leeches applied over the site of the tubercular deposits, or by counter-irritants to the upper parts of the chest. Inhalation has been resorted to, and in many cases with gratifying success. The duration of this disease depends upon a great variety of circumstances, and varies from a few months up to four, five, or more years. The average, however, may be taken at about two years; but many of the cases terminate fatally between the fourth and ninth month.

PHYLLOTAXIS, *fil'-lo-tak-sis* (Gr., *phullon*, a leaf; *taxis*, arrangement).—The arrangement of leaves on the stem. The laws which regulate the development of leaves have been carefully studied, and botanists have arrived at the conclusion that all leaves and their modifications have normally a spiral arrangement on the stem. This arrangement is not evident when the *internodes* (*see* LEAF) are suppressed; but in *alternate* leaves it can generally be made out. We may here state that leaves are said to be *alternate* when a single leaf is produced at a *node*, and the nodes are separated, so that each leaf occurs at a different height on the stem. The spiral growth of such leaves was first noticed by Bonnet, nearly a century ago. The suppression of the internodes, or spaces between the nodes, may render the spiral arrangement of some leaves obscure; but it can be proved that all leaves are developed in this way. When two leaves are produced at a node, they are usually placed on opposite sides of the stem, in which case they are said to be *opposite*. When three or more leaves arise from the stem, so as to be arranged round it in a circular manner, they are said to be *verticillate*, or *whorled*, and each circle formed by them is termed a *verticel* or *whorl*. Only one leaf can arise from the same point; but it sometimes happens that a number of leaves are brought into contact by the suppression of the internodes of a branch, in which case they form a *tuft* or *fascicle*, and are themselves said to be *tufted* or *fascicled*.

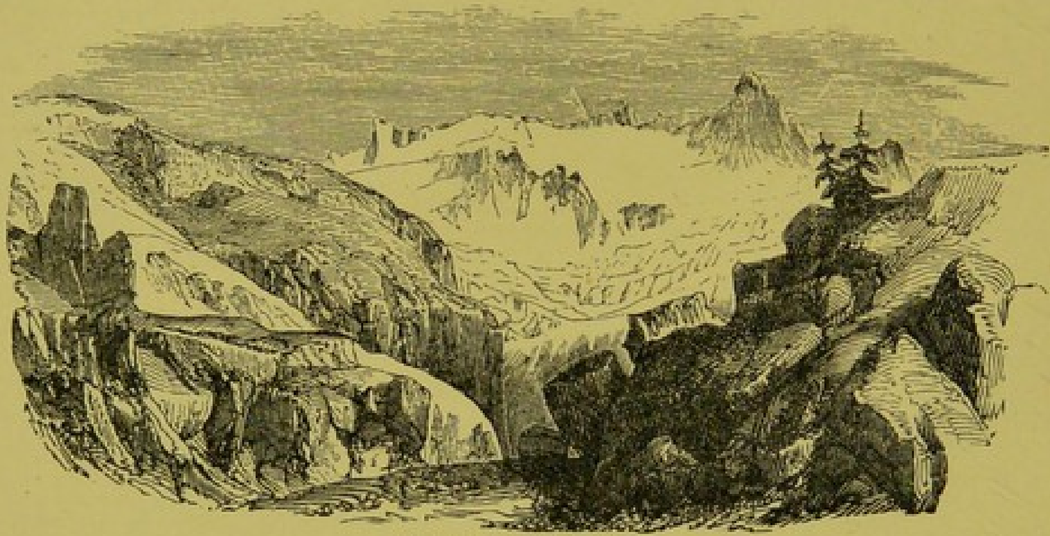
PHYLLOXERA, *fil-loks-e'-ra* (Gr., *phyllon*, a leaf, *xeros*, dry).—A genus of minute insects of the order *Hemiptera*, sub-order *Homoptera*, and allied to the Aphis and Coccus families. They are very destructive to vegetation, attaching themselves to plants and feeding on the juice. *P. vastatrix*, has greatly devastated the vineyards of France. It is supposed to have been imported from America.

VOLCANO OF JORULLO.



GRANITIC ROCKS.

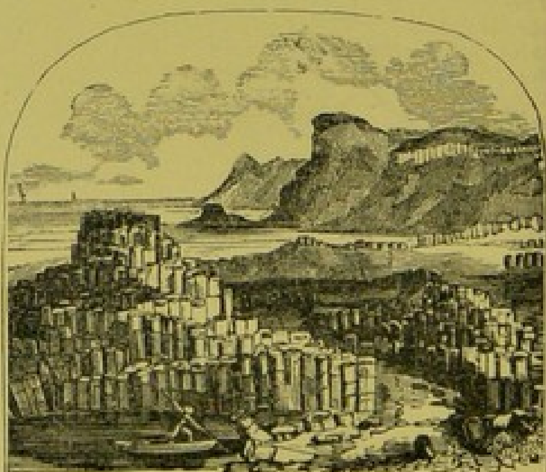
UNCONFORMABLE STRATIFICATION.



GLACIER OF THE RHONE.

CRICH HILL, DERBYSHIRE; ARCHED STRATA.

A FJORD ON THE NORWEGIAN COAST.



BASALTIC PILLARS.

PHYSICAL GEOGRAPHY.

PHYSALIA, *fi-sa'-le-a.*—A genus of *Acalephæ* (which *see*). It is about five or six inches in length, with an oblong body, mostly an air sac, and many appendages hanging from the under side, the shorter being suckers, kept in motion for securing prey, and extracting nutriment from it, while the longer can be extended to the length even of 16 or 18 feet, and possess a stinging property, causing great pain and constitutional irritation to a person taking hold of the rope-like tentacles. *P. pelagica* is known among sailors as the Portugese man-of-war. Physalia are met with chiefly in warm latitudes, but some have been found on the British coasts.

PHYSALIS, *fis'-a-lis.*—A genus of plants of the natural order *Solanaceæ*, annual and perennial herbaceous plants and shrubs, most abundant in temperate and warm climates, but met with in nearly all parts of the world. *P. alkekengi*, the Common Winter Cherry, cultivated in our flower-gardens, is a perennial, a native of the South of Europe and a great part of Asia. The berries have a sweet but slightly acid flavour. *P. edulis* is known as the Love Apple.

PHYSETER, *fi-se'-ter.* (*See* CACHOLOT.)

PHYSIC NUT.—A genus of plants (*Curcas*), tropical shrubs or trees, well known for the acrid oil of the seeds, which are emetic and purgative, and poisonous if taken in large doses. The expressed oil of an East Indian species (*C. purgans*) is used in medicine like castor oil, and also in lamps. The stem of *C. lobatus*, a Peruvian species, yields on incision a clear bright liquid, which hardens and becomes black, and is a very powerful caustic.

PHYSICAL FORCES, CORRELATION OF THE. (*See* FORCE, FORCES.)

PHYSICAL GEOGRAPHY, *fiz'-e-kal* (Gr., *ge*, the earth, and *graphe*, a description).—Strictly, a description of the physical features of the earth; but it has come to receive a much wider signification. Physical Geography includes —1. Mathematical geography, which treats of the figure, magnitude, and density of the earth; its position in the planetary system, and the method of delineating the surface of the earth, as artificial globes, maps and charts, and of determining the position of any particular place. (*See* EARTH, ECLIPTIC, EQUATOR, DEGREE, LATITUDE, and MAP.) 2. A knowledge of the material features of the earth's surface, and the physical forces which have induced and are modifying it. This includes the proportions of land and water, the formation of continents and islands, mountains, volcanic and glacier action; the extent, depth, currents, temperature, chemical composition, tides and evaporations of the ocean; river systems, with their watersheds and areas of drainage; geological features of the earth's surface, and climate, including zones, isothermal lines of average temperature and rainfall. 3. The distribution of animal and vegetable life and mineral products.

Size and Shape of the Earth. (*See* EARTH.)

Proportions of Land and Water.—Very little more than one-quarter of the entire superficies of the globe (196,000,000 square miles) is occupied by land, estimated at nearly 51,000,000, of which 37,000,000 are in the Eastern hemisphere and 14,000,000 in the Western. In the former, the preponderance of land is to the north of the equator; in the latter it is more equally divided. Taking the entire surface of the globe into account, only a very little more than one-quarter of the whole extent of land is to the south of the equator. If a globe on which the superficial features of the earth are delineated is turned so that the greatest mass of land is visible, it will be found that London is as nearly as possible the centre of the hemisphere so brought into view. (*See* ILLUSTRATIONS, Plate 81.) It must be remembered that those portions of the earth's surface described as land are only those parts which are above the surface of the sea, which, not sufficient in quantity to cover the whole surface of the globe, reaches only to a certain height, and covers formations similar to those which are left exposed to view. Beneath the surface of the sea are mountains, valleys, ridges of elevated land, and extensive plains; but the action of the water has given to the steepest descents a certain roundness of curve and outline. The mean height of the surface of the dry land does not exceed one-fifteenth of the mean depth of the bed of the ocean.

Changes in the Conformation of the Land.—Considerable changes of the sea-level have occurred and are in continual operation. The traces of "ancient sea-margins," or beaches far above the present sea-level, are visible in both hemispheres, and are well-known to geologists. Chalk ridges, such as those of Kent, Surrey, and Sussex, were, it is almost certain, at some remote time, cliffs bounding a sea, which has washed away the surface of the lower land. Two forces of a contrary character are constantly at work, varying the conformation of the coast-lines. The sea is continually undermining and washing away the softer rocks, in many places leaving irregularly shaped pinnacles and other fragments. Caves have been scooped out by the action of the waves; and the lower portions of chalk cliffs having been washed away, the overhanging upper parts have fallen in fragmentary masses, which resist the further action of the sea, and in course of ages become covered with a thin soil, so adding to the area of the land. The cliffs having been destroyed, the sea enters by the breaches and submerges low-lying districts; and the tide-currents also sweep along the coast, bearing in suspension a vast quantity of matter, which is finally deposited in eddies, and thus land-banks and shingle-deposits are formed, and bars at the mouths of rivers increased. The other force in constant operation is that of many of the great rivers, which deposit alluvial matter brought from the inland districts through which they flow. Through these accumulations, the river forces its way by many channels, forming what is known as a delta, from the approach in form to the triangular Greek letter so named. The delta of the Nile is one of the most generally familiar instances of this accumulation. The Ganges deposits annually about 534,000,000 tons of solid matter in the delta through which it reaches the sea; the Mississippi of North America nearly 293,000,000 tons, and the Irrawady, in Burmah, more than 182,000,000 tons. Still more stupendous forces have been in operation at remote times, and in a modified degree are operating now, the most remarkable being the cooling of the exterior crust of the earth and the action of volcanoes, producing mountain ranges, depressions, and variations of level. (*See* MOUNTAINS and VOLCANOES.) Considerable modifications of the surface are produced by the movements of glaciers, huge masses of ice, formed from the snow which falls and slides into the deep valleys of the lofty mountain-chains. (*See* GLACIER.) A regular, if slow, elevation of the land is continually taking place, the changes extending over a considerable portion of the earth's surface. Observations show that the Scandinavian peninsula of north-western Europe is rising on the eastern coast at the rate of four feet in a century; and the whole of the western coast of South America, and nearly half of the Pacific islands, are supposed to be gradually rising, not by accumulation of soil alone, but by a gradual up-heaving, due to the continuous exertion of subterranean forces. A contrary process has been observed in Denmark, Holland, Belgium, and the south shore of the Baltic generally, which are slowly sinking; and there is a depression of the Atlantic coast of North America, from Cape Cod to Cape Hatteras, to the extent of about two feet in a century.

Masses of Land.—The great mass of land in the eastern hemisphere consists of Asia and Europe (physically one continent), and Africa, connected only with Asia by the narrow Isthmus of Suez. It is noticeable that the northern extremity of Europe and the southern extremity of Africa are nearly under the same meridian of longitude, and the same observation applies to Asia, the North-east Cape and the extremity of the Malacca peninsula both lying near the meridian 100° E. Another noticeable peculiarity is that nearly all the principal promontories of the world stretch in a southerly direction, the exceptions to this rule being very few. There is a certain similarity of conformation between the southern peninsulas of Europe and Asia: Spain and Arabia, Italy and India, Greece and the Malacca peninsula, with their archipelagos, may be instanced; and there is a degree of parallelism between portions of the western coasts of Europe and Africa and the eastern coasts of North and South America. But there is a striking dissimilarity in the general contour of the continental masses in the eastern and western hemispheres. In the former, the prevailing direction of the land is from east to west; in the latter, from north to south. In another respect, there is a similarity between the eastern and western continental masses. Africa is united to Asia by the narrow Isthmus of Suez, and South America to North America by the Isthmus of Panama. The outline of the great continents varies considerably. Europe, Southern Asia, and North America are very irregular in shape, with numerous peninsulas, bays, and narrow inlets. Africa, South America, and Australia (which, although an island, may from its great size be considered as a continent) are more compact.

Islands and Coral Reefs.—Volcanic or eruptic forces are active in adding to the extent of the surface of the earth by the production of islands, the results of violent upheavals. When exerted beneath continental masses of land, upheavals of the surface are produced, but no extension of area is observable; when beneath the bed of the sea, the tops of the mountains so formed emerge from the water, forming islands. Many of the islands and island groups of the Atlantic, Pacific, and Indian Oceans are of volcanic origin, and in the Indian archipelago alone are more than 900 volcanoes, a large number of which have been active within recent times. It is observed that volcanoes are generally linear in arrangement—a peculiarity especially observable in the ranges of volcanic islands of Eastern Asia. There are more volcanic islands connected with Europe and Asia than with America, where they are generally continental. In the Mediterranean, Sicily, Stromboli, the Lipari islands, the Greek islands of Milos and Santorin, and the small Italian islands of Ischia and Procida, are of volcanic origin. In the Atlantic, the Canary Islands, Ascension, St. Helena, and the Azores, are of the same formation; and in the Pacific, the Fiji, Friendly, Society, Sandwich, Ladrone, and Norfolk Islands, and the groups of New Guinea, New Britain, New Hebrides, and others, are also of volcanic origin. Sudden in operation, the results of the volcanic force can be observed, and effects are produced in a few hours equal in extent to the results of other natural operations spread over unknown periods. Islands have appeared, and some have disappeared almost as suddenly as they emerged. Islands are generally classed as *continental* and *oceanic* (or *pelagic*, "belonging to the deep sea"). The former are those which, from their proximity, and geological and other peculiarities, show a connection with the continents near which they are situated. Oceanic, or pelagic, islands are at a distance from the mainland, with which they have no physical connection, and are nearly in every instance of volcanic or coralline formation. (*See* ATOLL and CORAL REEFS.) The Pacific Ocean contains more islands of both kinds than any other part of the world. *Archipelagos* are seas containing clusters of islands, the word being frequently applied to the island groups themselves. The principal archipelagos are: Continental Islands—the Greek, Indian, and the Antilles (commonly known as the West Indies); Oceanic Islands—the Low, Caroline, Friendly, Society, and Fijian groups in the Pacific. The largest island masses in the world are Australia, Borneo, Madagascar, and Papua, or New Guinea.

Plains, Valleys, and Deserts.—The term *plain* is geographically applied to an extent of generally flat country, having but a slight elevation above the level of the sea, and being in some instances below it. The description does not intimate perfect conformity of surface, for a plain may be undulated, studded with low hills, or traversed by valleys and intersected by ravines. *Valleys* are the hollows formed by opposite ranges of hills or mountains, and, according to their direction, are known as *longitudinal*, *transverse*, and *lateral*. Longitudinal valleys separate parallel ridges of a chain, and follow its general course; transverse valleys cut the ridges in an angular direction; and lateral valleys are those that lead into the others. All serve as channels for the collected waters of the streams, which rise on the slopes, and then become the beds of streams. The sides of transverse valleys (known variously as gorges, defiles, ravines, and glens) are generally steep, and the streams falling into them are mountain torrents, rushing with great velocity, and forming falls and cataracts; but in the longitudinal valleys, which ordinarily have more gently sloping sides and longer courses, the rivers flow more tranquilly. In old writings the word *desert* implies an uninhabited tract, whether fertile but unoccupied, or barren and therefore "deserted." Geographically, the term is limited to the large tracts of sand, gravel, rocky masses, flints and siliceous stones, of which there are so many in the continents of the eastern hemispheres, but which are of rare occurrence in the two Americas. Regions of this desolate character stretch in a nearly continuous zone from the Atlantic Ocean through the north of Africa and Central Asia towards the Pacific. In some deserts there is clear evidence of ocean or lacustrine beds; but others are of greater elevation. The deserts of the Old and New Worlds and Australia occupy about 7,000,000 square miles of the earth's surface, nearly twice the area of the continent of Europe.

The Oceans.—It is mentioned above that about three-fourths of the surface of the globe is covered with water. To this vast body of fluid the name "Ocean" is generally applied; but for convenience of description, various names are appropriated to different portions, which occupy "basins," or vast depressions, possessing somewhat varying characteristics, or partially separated by continental masses. The immense expanse between the continents of Europe and Africa on the east and the two Americas on the west is known as the *Atlantic Ocean*—a name given by the old geographers to the little-known waste of waters westward of the Atlas mountains. The *Indian Ocean* lies between the east coast of Africa, the Indian archipelago, and the west coast of Australia. The *Pacific* is the name given by Magalhaens, or Magellan, the Portuguese navigator, to the vast and and comparatively tranquil sea he entered after passing the strait which bears his name, at the southern extremity of South America. It lies between the western coast of America and Asia, New Guinea, and the east coast of Australia. The Atlantic and the Pacific are each divided by the equator into North and South oceans. The *Arctic Ocean* surrounds the North Pole, and is bounded by the northern shores of Europe, Asia, and America, extending southward in the openings between the continents to the Arctic circle, or about long. 64° N. The *Antarctic Ocean* surrounds the South Pole, and is understood to be limited by the 64th parallel of such latitude. The term *sea* is ordinarily applied to large inlets, nearly "mediterranean" (that is, surrounded by land), or bays formed by vast curves of the coasts of the continents. The extent of the respective areas of the large oceans may be approximately indicated:—

	Square Miles.
Atlantic	25,000,000
Indian	20,000,000
Pacific	70,000,000
Arctic	10,000,000
Antarctic	20,000,000

Salt Lakes and Ocean Beds.—There are many salt inland seas and lakes, some of them of great size, both in the Old and New worlds. The largest is the Caspian, which receives the Volga, one of the largest of European rivers, and other considerable rivers, and has no visible outlet; the water, varying in different parts, being much less salt than the ocean generally. There are many places on the surface of the earth where the water has altogether disappeared by evaporation, leaving large tracts impregnated with salt, and known as salt plains, or in some parts of America, "salt licks," from animals occasionally licking the surface for the sake of the salt, which they instinctively know to have a medicinal effect. The Dead Sea, in Syria, is a remarkable instance of a large piece of water—about forty miles long, with an average breadth of nine miles, intensely salt, and having no visible communication with the ocean.

Ocean Currents.—The water of the ocean is perpetually moving, not only on the surface, but by the action of currents, or immense streams moving around and about the surface of the globe, in obedience to certain motive forces. These are principally, the force of winds; the tidal force (explained hereafter); differences of temperature, which expand or contract water by heat and cold; the evaporating power of the sun; melting of masses of ices at the poles; and the revolution of the earth about its axis. There are *drift currents* and *stream currents*, the former due to the action of winds upon the surface water, impelling it to leeward (or in a direction contrary to that from which the wind is blowing), until, meeting with some obstacle, land or sandbanks, its progress is arrested, and an accumulation of water produced. The drift current then gives rise to a stream current, carrying off the collected waters, and restoring the equilibrium of the surface of the ocean. The average velocity of a drift current is about half a mile an hour; that of a stream current is not unfrequently five miles an hour. There are also *periodical, constant, variable,* and *counter currents.* Periodical currents occur at certain seasons of the year, the time of which is generally known to navigators, and are due to the action of tides and winds, especially monsoons—those winds which, in the Indian Ocean, blow from the south-west from April to October, and from the north-east from October to April, the two periods of change being generally accompanied by great atmospherical disturbance. Constant currents are, as the name implies, in continual operation—the great oceanic rivers, as they have been named, perpetually flowing. Variable currents are occasioned by the action of the tides, changeable winds, and the melting of ice, which is obviously uncertain as to period or duration. Counter currents are those remarkable streams that flow alongside other currents, but in opposite direction. These are in some instances very remarkable, as a cold current will be observed running southward in immediate proximity to a hot currrent having a northward direction.

Depth of the Ocean.—The greatest known depth of the sea does not exceed about 9,300 yards, and that is found in the Pacific Ocean, lat. 44° 55′ N., long 150° 26′ E. The greatest depth of the Atlantic, so far as yet ascertained, is 7,750 yards. The greatest depth of the sea, then, does not approach the greatest height of our mountain ranges; for instance, Mount Everest, in the Himalaya range, is about 9,700 yards high. The pressure which weighs down the lower strata of the sea is equal at the depth of 4,500 yards to nearly four atmospheres, and that is the principal reason why it will be found impossible to explore the abysses of the ocean by means of any diving apparatus. It was formerly supposed that the greatest depths of the ocean were to be sought for at a distance from the coast and in the centre of the open seas; but, according to the results of the latest deep sounding, this is not the case. The greatest depth of the North Pacific Ocean was found near the western shore—that is, in the neighbourhood of the Continent of Asia. The Atlantic also shows the remarkable fact that its greatest depths are found near to the islands or the mainland along the western coast. In the Indian Ocean the deepest soundings were taken on the eastern side, and near the Australian continent; and as far as our present knowledge extends, the South Pacific is the only ocean in which the deepest soundings are found in the centre. Mainlands and islands are often connected by flat shallow stretches of sea, or by submarine plateaux, and so form together a common tract of elevation measured from the centre of the globe as the starting point, and separated by the great depression of the ocean beds, which are measured with reference to the same centre.

Temperature of the Ocean.—Increase of depth is accompanied by decrease of temperature. Salt water contracts down to freezing point, and therefore, as it becomes colder in proportion as it is heavier, the coldest water is always found in the lower strata. The temperature of the surface of the sea in districts lying within the tropics is rather higher than that of the air above it. Humboldt estimated that the highest average temperature of the sea was about 60° at eight or nine degrees north of the equator. The temperature of the sea sinks over shallows and reefs. There is a line of unvarying temperature, about 39° Fahr., marking the limit of the influence of the sun's heat. In equatorial regions the line is at the depth of more than 7,000 feet. About lat. 56° 26′ N., and the same parallel S., it rises to the surface, the water having the same temperature at all depths. Farther north and south, to about 70° N. and S., the line of unvarying temperature descends to 4,200 feet, a warmth retained in the deepest parts which have been reached. We may therefore conclude that the normal heat of the sea in all parts, when beyond the range of action of the sun's rays, is about 39° Fahr., or 7 degrees above freezing; and it has been ascertained that seasonal vicissitudes of temperature produce no effect at the depth of 300 feet. The district of the ocean near the North Pole shows open the grandest scale of the formation of vast ice masses; but the Antarctic, or southern waters, are able to send their masses of ice much nearer to the equator than the Arctic ocean does, the reason being that the southern hemisphere is much colder and moister than the northern. It is chiefly due to the warm currents that the temperate regions of the northern hemisphere are protected against the invasion of frozen masses.

Saltness of the Ocean.—In sea-water the peculiarity is imparted by the presence of various inorganic matters in proportions varying in different localities from 33 to about 43 parts in 1000. The principal of these saline matters are chloride of sodium (common salt), nearly 80 per cent. of the whole, chlorides of potassium and magnesium, bromide of magnesium, sulphate of magnesia, and sulphate and carbonate of lime. At least twelve other elementary substances, including metallic bases, have been discovered by careful analyses, but in such minute quantities as not materially to affect the general characteristics of the fluid, their presence being only perceptible in sponges, sea-weeds, marine animals, or in the deposits on the boilers of steam vessels making sea-voyages. Whence come these salient ingredients? is the question naturally asked; and the answer now accepted as generally satisfactory is, they are brought down by the rivers discharging into the ocean. Every little spring which contributes to the formation of a river brings to the surface a portion of the earth through which it forces its way upwards, and that earth contains saline and other earthy elements. Indeed, many springs are so highly charged with mineral elements that the water is quite unfit for ordinary consumption, though of great medicinal value when taken in small quantities. The "spas," or mineral springs, so much resorted to in England, Germany, North America, and other places, are familiar instances of this. The materials thus held in solution are carried by the river to the sea. It would appear, then, that spring and river water should be as salt as the sea, or even more so, because the vast body of the latter would dilute the salt-charged water of the rivers. The fact, however, is that the proportion of the saline elements in river water to the general bulk is so minute, that it is scarcely perceptible; but that the chlorides, sulphates, and other elements are stored up in the sea, the fresh water being continually lost by evaporation, which returns a considerable portion to the earth in the form of rain. The saline elements therefore accumulate, and the fresh water does not. Within the zones of greatest heat the evaporation is considerable, and consequently the proportion of saline ingredients large; and in partially landlocked seas, where the influx of ocean water more than counterbalances that of river water, and the evaporation is unchecked by cold winds, the saline deposits are in excess of the average. It has been estimated—of course, complete accuracy on such a subject cannot be looked for—that every year the rivers of the world dissolve and carry into the sea about a hundred tons of earthy matter for every English square mile of surface, or altogether more than five billions of tons.

Colour of the Sea.—The colour of the ocean varies considerably in different parts—a fact which has given rise to the popular names, White, Yellow, Red, and Black, applied to seas which exhibit marked departures from the general standard. The propagation of light through water is not carried far below the surface, the influence at the depth of 300 feet being scarcely equal to the glimmer of twilight, and at about twice that depth there is perpetual darkness. Light, on entering the water, is refracted, and more or less resolved into its primary colours. Red, orange, and yellow rays do not penetrate to so great a depth as blue and violet, and consequently the colour of the reflected light will depend to a considerable extent on the depth at which the reflection takes place. But the sea is also a vast mirror, and gleams of sunshine, the tints of the atmosphere and of passing clouds are reflected. It also contains myriads of animalculæ, and substances intermediate between the animal and vegetable kingdoms; and changes of colour are produced by the nature of earthy substances infused. In the Gulf of Guinea the sea appears to be white; and around the Maldive Islands, in the Indian Ocean, black; beautiful purple, red, and rose-coloured waters are seen in the Mediterranean; off the coast of California is the Vermillion Sea, which fitly expresses the prevailing colour; and in some parts of the Arctic Ocean green and blue are seen in juxtaposition. The beautiful appearance resembling scintillations and long lines of apparently electric light is due to the presence of innumerable animalculæ. (*See* PHOSPHORESCENCE OF THE SEAS.)

Springs, Rivers, and Lakes.—All the water which rises to the surface of the earth in springs, all the rivers, great and small, which flow into the ocean, all the enormous fresh-water lakes of the Old and New Worlds, come from the rain which descends upon the earth, and that rain is the result of the evaporation from the ocean, and, now that the lakes and rivers exist, from them too, under the influence of heat. All the moisture raised by evaporation, condensed in the upper strata of the atmosphere, and then falling as rain, snow, and hail, is not immediately returned to the earth, a considerable portion being arrested and absorbed by the vegetation, to which it is necessary for the preservation of life. There is a continual return to the earth of the water abstracted from the sea by evaporation—a perpetual circuit of moisture; and the next step in the inquiry is to ascertain how the restoration is effected.

Springs.—It is easy enough to imagine that when rain descends on mountains it rolls swiftly down the steep slopes, forming mountain torrents, and that many of these uniting, according as the conformation of the land affords channels, great rivers are formed, which traverse the lower ground and ultimately find their way to the sea. The land is not all elevated; there are extensive plains and valleys on which the rain descends, and where there is not the momentum of gravity derived from a rapid fall, to force the water onward and so form a stream. Besides, it is one of the most familiar facts that the greater number of rivers do not have their origin in mountain torrents formed directly by the rainfall, but rise from springs, or comparatively small fountains of water, apparently coming from the interior of the earth. These springs, like the mountain torrents, are fed by the rain, although in the one case the process is less visible than in the other. All rocks and minerals, even those we consider to be the hardest, are permeable by water; for rocks and minerals are all composed of variously-shaped grains, crystals, or particles, and the water works its way through the interstices, or even through the particles themselves. The hard rocks above ground and the hard rocks below ground alike afford innumerable channels by which the rain makes its way to a considerable depth below the surface. Access to the narrow channels having thus been made by the force of gravity, two other powerful agents, frost and the chemical action of the water, come into operation. Water, as is well known, expands when freezing, and the contained water expands, fracturing the rock and increasing the number of cracks. As the existing channel widens, and new ones are formed, more water enters the rock, more ice is formed, and the force exerted continues to increase until the block of rock is completely broken up. It then becomes subject to the chemical action of water, which falls upon its surface and permeates its substance. In descending through the atmosphere, the rain absorbs some of the ingredients of the air, among them carbonic acid gas, which is present in the proportion of 1 volume to 2,500, and to which, especially in volcanic districts, large additions are made from fissures in the earth, from which the poisonous gas issues. It is also produced by the decay of vegetable matters; and as the rain not only descends directly on the rocks, but also reaches them after having washed in some cases a considerable space of the surface of the earth, it is commonly highly charged with the gas. The water fills the crevices, and the carbonic acid at once acts upon the rocks, dissolving the substance. Chalk or limestone is dissolved and carried away, and few rocks, even the hardest, can resist the action. As the cracks or channels become more capacious, the weight of the water itself becomes an additional means of forcing its way downwards to the underlying strata. In some limestone districts the decomposition of the rock, from the effect of the carbonized rain, forms vertical cavities, into which the surface drainage flows, and in course of time the water makes a system of channels through the limestone, forming vast grottoes and caves. But a considerable portion of the water which has made its way underground is not arrested in its downward course until it has reaced a depth perhaps of many thousand feet, when its farther progress is stayed by some impermeable stratum. Its force has increased with the depth, and a mass of water of great weight is formed, which travels laterally until some opening to the surface is met with; and then it rushes upwards with irresistible force, and reaching the surface, forms springs, which, discharging on the surface, become the sources of brooks and rivers. When the impermeable stratum lies near the surface, so that the rain-water cannot sink to a great depth, there are marshes, with a rank vegetation. Rivers, then, are fed by the rain which runs off the surface, and by springs, which restore to the surface the rain which has sunk into the earth. There is a continuous circuit, the only loss being the amount of water which remains in the limestone strata and the cavities filled by underground lakes. Ordinary spring water contains a small amount of carbonate and sulphate of lime, common salt, and chlorides of calcium and magnesia. Sometimes the quantity of lime, or of silex, is so great that it is deposited at the surface, on wood or other objects exposed to its action. When shells, twigs, or other substances are covered with a crust of the mineral, the springs are known as *incrusting* springs; when the exposed substances are so saturated with the mineral as entirely to change their character and resemble stone, the springs are described as *petrifying*. *Chalybeate* or ferruginous springs contain iron in solution; *saline*, various salts; *aërated*, carbonic acid gas; and *sulphureous*, sulphur. Some well-known springs contain a mixture of these substances; and in particular districts the various kinds of springs are in close contiguity. There are saline springs so highly charged with salt that they are known as *brine* springs, and the deposits form beds of rock salt.

Rivers.—Whether rising from springs, or descending on the surface from elevations, the origin of rivers is generally the union of various small streams, which collectively form a body of water to which the more dignified name of river is given. Some rivers, however—as the Rhone—originate in glaciers, which bring down immense bodies of frozen snow from the summits of lofty mountains, as described in our notice of glacial phenomena. All rivers are swollen by rain in the wet season; and in some countries (remarkably so in South Africa and Australia), the beds of rivers which are rushing torrents at certain periods, are waterless channels in the dry season, the loss by evaporation having more than counterbalanced the scanty supply from the original sources. Rivers rising at great elevations, either from springs, melted snow, or excessive rainfall, and formed by the union of many mountain torrents, exert a tremendous force in removing the obstacles which the formation of the ground and the nature of the rocks may present to their rapid descent to lower regions. In some instances they topple over precipices, forming stupendous cataracts. In such cases, the chemical elements with which the waters are charged do not produce much effect on the rocks, the motion of the stream being too rapid; but the marvellous force of the river wears away the rock by erosive action, the fall recedes, and deep ravines are formed, the sides of which retain a vertical character. Natural bridges are caused by the washing away by water power of the softer strata of rock, leaving a barrier of harder substance, which remains because the water has free way beneath it. The most stupendous gorges in the world are the Cañons (from a Spanish word meaning a tube or pipe), formed by the Colorado and other rivers, rising among the lofty Rocky Mountains of western North America. These rivers flow through ravines thousands of feet deep, cut out in vast tablelands, and with perpendicular sides. (*See* RIVERS and TIDES.)

Lakes.—Lakes are, in the greater number of instances, expansions of rivers, spreading over vast tracts of level country, or filling up depressions in the earth's surface. The great group of American lakes—Superior, Huron, Michigan, Erie, and Ontario, which cover 114,000 square miles—are expansions of the St. Lawrence; and similarly the immense lakes of Central Africa, discovered within the last few years, are parts of the great river systems of that continent. Other lakes have no visible outlet and receive no streams; and some receive rivers but have no discharge, the surplus water being carried off by evaporation.

Climate. (*See* CLIMATE, MONSOONS, TRADE WINDS.)

Distribution of Vegetable Life.—Every species of plant depends for existence upon certain physical conditions. These conditions may be special or general—that is, the plant may, from its peculiar individual organization, demand peculiar surroundings, or it depends, as all plants do, on the general conditions necessary to support the life of the comprehensive species to which it belongs. If the conditions of existence are special, the plant cannot be widely diffused; if general, the diffusion will be proportionately extensive. It is obvious that in the regions where any form of vegetation thrives without the aid of cultivation, the conditions of its existence must be most favourable; and that, if careful cultivation be added to natural advantages, the utmost development of which any particular plant is capable may be looked for. Heat, light, and moisture being essential to vegetation, and affecting its development, it follows that, other things being equal, there would be a general correspondence between the isothermal, the climatic, and vegetable zones; but there are facts which must be taken into consideration. One of the most influential is the variation of elevation above the sea-level. Temperature decreases in proportion to elevation, and that decrease necessarily affects the character of the vegetation in mountainous districts. A primary condition is that the luxuriance of vegetation decreases as higher parallels of latitude, either north or south, are reached, heat and light being diminished in proportion to distance from the equatorial regions; another condition is that the luxuriance of vegetation also decreases in proportion to elevation above the sea-level. Similar results are exhibited in each case, and the upper portions of lofty mountains near the line of perpetual snow, even in the tropics, exhibit a vegetation having a close relation to that of the regions bordering on the Arctic circle, the plants being limited in variety and scarcely rising above the surface of the ground. In the Old World, the southern limit of the polar flora near the sea-level lies nearly within the Arctic circle, but the characteristic flora stretches along the top of the Scandinavian mountains, and reappears in the high lands of Scotland, Cumberland, and Ireland, on the summits of the Pyrenees, Alps, and other mountains in southern Europe, as well as on the mountains of Central Asia, and the high ridges of the Himalayas. Mr. Ball, who has given great attention to the botany of the Alpine districts, tells us that about one-sixth of the Alpine flora are common to the Arctic flora.

Delineation of the Surface of the Earth. (*See* LATITUDE and LONGITUDE, MERIDIAN.)

PHYSICS, *phiz'-ziks* (Gr., *phusikon*, natural, Fr., *phusis*, nature).—In its most general signification, this term is applied to the science of nature; but it is commonly in a more restricted sense, and so those sciences which treat of *matter*, becomes synonymous with *Natural philosophy*. Physics, however, considered as natural philosophy, deals with matter in its integrant forms, and points out those properties which belong to matter universally, and those laws the operation of which is understood when we make use of the term *matter*. The whole science may be divided into two great heads,—abstract physics, and concrete physics. The former treats of mechanical philosophy, including under it mechanics, hydrostatics, and hydraulics, together with chemical philosophy, optics, electricity, and magnetism. The latter comprises descriptive and philosophical natural history, physiology, geology, and physical astronomy, together with concrete chemistry, both analytical and explanatory. It also includes zoology, botany, descriptive astronomy, meteorology, mineralogy, and physical geography.

PHYSIOGNOMY, *phiz-e-on'-o-me* (Gr., *phusiognomonia*, from *phusis*, nature, and *gnomon*, a rule or measure).—The art of determining the inward character of an individual from his countenance. That the mental character of an individual tends to stamp itself upon the countenance there can be little doubt; though it is very difficult, or perhaps impossible, to lay down any fixed rules upon the subject. Certain feelings and passions of the mind manifest themselves by certain expressions of the face; and as these come to be frequently indulged in, they come to give a permanent cast to the countenance. Della Porta, an Italian writer of the early part of the 17th century, described resemblances between the physiognomies of human beings noted for the possession of peculiar qualities, exhibited also by the personscompared with them. Some modern writers and artists have advocated this theory. The most popular writer on physiognomy is Jean Gaspard Lavater, a Swiss pastor, who published several works on the subject between 1772 and 1781.

PHYSIOLOGY, *phiz-e-ol'-o-je* (Gr., *phusis*, nature, and *logos*, discourse).—The doctrine or science of nature, comprehending a knowledge of all the physical and natural sciences; and this was the meaning which it originally bore. But as these, in course of time, came to be more particularly studied, they received distinct names, as natural philosophy, chemistry, astronomy, zoology, geology, &c. To the science which treats of the functions of living beings the term physiology is still applied, though its meaning is becoming more and more restricted as its various branches become better defined. It is divided into animal, or comparative physiology, which treats of animals, and human physiology, which deals with man. By physiology, as at present used, is generally understood a knowledge of vital actions in a state of health, as distinguished from pathology, which is a knowledge of the same functions when deceased. Physiology is generally considered to embrace a description of the various vital functions of the parts composing the human body, as well as the more intimate structure of the parts themselves; the relations of these parts to each other being referred to descriptive anatomy, and their chemical composition to animal chemistry. The modern science of histology deals with the elementary textures of the human body and their several functions, and is the recognized basis of physiological knowledge.

PHYSOSTIGMA, *fi-sos-tig'-ma* (Gr., *phusa*, a bladder, and *stigma*, a stigma).—A genus of the natural order *Leguminosæ*. The species *P. venenosum* produce the Calabar ordeal-bean, so called from being used as a poisonous ordeal, to determine the guilt or innocence of accused persons. Taken internally, the beans, unless rejected by vomiting, produce fatal paralysis. It has recently been ascertained that the extract of the bean possesses a most extraordinary power over the iris, causing contraction of the pupil to such an extent that the aperture becomes completely obliterated. Its effect is, therefore, exactly contrary to that produced by belladonna. It will doubtless prove a valuable agent for the treatment of some diseases of the eye.

PHYTELEPHAS, *fi-tel'-e-fas.*—A genus of palms. The hard albumen of the seed of *P. macrocarpa* constitutes the vegetable ivory of commerce; it is extensively used by turners. The fruit which contains the seed presents some resemblance to a negro's head. It is so named from two Greek words—*phuton*, a plant, and *elephas*, elephant,—because it affords a milk which hardens into a substance like ivory.

PHYTOCRENE, *fi'-to-kreen.*—A genus of the natural order *Artocaraceæ*. The species are termed water-vines, on account of the large quantity of watery juice they yield when wounded. By many botanists this genus is considered to constitute a distinct natural order called *Phytocrenaceæ*. The plants are climbing shrubs, native of the West Indies, with dichlamydeous unisexual flowers, and seeds with a large quantity of albumen.

PHYTOLACCACEÆ, *fi-to-lak-kai'-se-e* (Gr., *phuton*, a plant, and *lakha*, gum-lac).—The *Phytolacca* family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*. The plants of this order—herbs, or under-shrubs—are natives principally of America, India, and Africa. The most noteworthy of them is *Phytolacca decandra*, commonly called poke, or pocan, in North America. Its roots are emetic and purgative, and are sometimes applied externally to cure itch and ringworm. Its ripe berries have been used medicinally in chronic rheumatism and syphilitic affections. Its young shoots are sometimes boiled and eaten as asparagus by the Americans.

PIA MATER (Lat., tender mother).—The name given to the innermost of the three investing membranes of the brain. (*See* BRAIN.)

PIASSABA, *pe-as'-sa-ba.* (*See* LEOPOLDINIA.)

PICA, *pi'-ka* (Lat., "the painted one," from *picta*, painted). (*See* MAGPIE.)

PICOTEES. (*See* DIANTHUS.)

PICRASMA, OR PIERÆNA, *pi-kras'-ma, pi-e-re'-na* (Gr., *pikros*, bitter).—A genus of the natural order *Simarubaceæ*. The species *P. excelsa*, a native of Jamaica, yields the officinal *quassia-wood* of the Materia Medica. It is much used as a tonic, febrifuge, and stomachic. Cups formed of quassia-wood are used to impart agreeable bitter to liquids which have been allowed to remain in them for some time. An infusion of quassia, sweetened with sugar, is much used as a fly-poison. The active properties of quassia-wood are due chiefly to the presence of an intensely bitter crystalline substance called *quassia*. In Jamaica, the plant is known as the bitter-ash or bitter-wood. (*See* QUASSIA.)

PICUS, *pi'-kus.* (*See* WOODPECKER.)

PIG. (*See* HOG.)

PIGEONS, *pij'-enz* (Ital., *pigione*). — A name given by some naturalists to all the species of *Columbidæ*, and almost equivalent to dove, but more generally restricted to the genus *Columba*. The distribution of the family is very extensive, the bird being found almost everywhere except within the frigid zones. The species are most abundant in Southern Asia and the great Indian Archipelago. Its general characteristics are—bill moderate, compressed, covered at the base of the upper mandible with a soft skin, in which the nostrils are pierced, and more or less curved at the point; feet with three divided toes in front and one behind. One part of the internal organization of the pigeon is worthy of special notice. The crop, in the state which is adapted for ordinary digestion, is thin and membranous, and the internal surface smooth; but by the time the young are about to be hatched, the whole, except that part which lies on the trachea, becomes thicker, and puts on a glandular appearance, having its internal surface very irregular. In this organ it is that the food is elaborated by the parents before it is conveyed to the young; for a milky fluid of a grayish colour is secreted and poured into the crop among the grain and seeds undergoing digestion, and a quality of food suited to the nestling is thus produced. The fluid coagulates with acids and forms curd; and the apparatus forms amongst birds the nearest approach to the mammæ of warm-blooded animals. The domestic pigeon is, there is little doubt, derived from the rock-pigeon (*C. livia*), a bird met with in nearly all parts of the world, breeding in crevices of rocks or caverns opening to the sea. This wild pigeon is about 12 inches long from the tip of the beak to the end of the tail, of a bluish-gray colour, with two bars of black across the wings, and shades of green and purple. There is a black bar across the tail, and the legs are of a reddish-orange colour. The Smaller Wood Pigeon, or Stock Dove (*C. œnas*), builds its nest in trees, preferring the hollows in decayed trunks, or the bushy tops of those that have been pollarded; but sometimes in holes in the ground. The size is rather more than that of the rock pigeon; it has a purplish-red breast, and no bars on the wings. It inhabits the greater part of Europe and Asia, and the north of Africa. Other wild pigeons are the Ring Dove, or Wood Pigeon (*C. palumbus*), the largest of the British species; the Ring-tail (*C. Caribbea*), a West Indian species, with peculiarly delicate flesh; another West Indian species, the White-headed (*C. leucocephala*); and the Double-crested (*C. dilopha*), a large bird a native of Northern Australia. (*See* PASSENGER PIGEON.) From a very early period, the ancient Greeks were well acquainted with pigeons; whilst the breeding of them amongst the Romans was quite a science. The same attention to them has been given by modern nations, and the adepts in the art of breeding them pretend that the almost innumerable varieties may be bred to a feather. The names bestowed on those varieties are indicative of their peculiarities; as *tumblers, croppers, runts, carriers, barbs, crowned, rough-footed, Jacobins, fantails*, &c. (Pictures of some of the varieties are given in the Illustrations, Plate 78.) Pigeons have no song, their note being a simple cooing. The prevailing colour of the pigeon is bluish-gray, of various intensities and shades, frequently embellished upon the neck with feathers having a metallic lustre and peculiar form, and which exhibit various tints of colour according to the light in which they are viewed. Their flesh is nutritious, being of a warm and invigorating nature. Their flight is powerful, very rapid, and can be long sustained; and many species are in the habit of making distant periodical migrations. The *carrier* deserves notice, if it were only for the fact that it is honourably noticed by some of the most famous writers of classical antiquity. Anacreon, the great Greek lyric poet, has mentioned it as the bearer of epistles; Pliny, the famous Roman naturalist, speaks of the communication kept up between Hirtius and Decimus Brutus at the siege of Mutina (Modena); and there is recorded an instance of their having been employed during the crusade of St. Louis. It was at a very early period employed in this country as a conveyer of messages. Carrier pigeons have been known to fly a mile in 90 seconds.

Pigeon-House, or Dovecot.—This should be divided into cells, one for each pair, and large enough to hold them comfortably, with a slip of wood in front of the door for the birds to sit on. It should be painted white, and placed at such a height as to be safe from depredators. Pigeons breed every month, except in very cold weather, and the male and female are faithful to each other from year to year.

PIGEON-PEA.—A kind of pulse (*Cajanus*), a native of the East Indies, but cultivated in Africa and the West Indies, and capable of cultivation as half-hardy in the south of England. It is a shrub about 18 inches high, and the finer kind of pulse is nearly equal to the English pear.

PIGMENT, *pig'-ment* (Lat., *pigmentum*).—A name given to the mucous substance which covers the surface of the iris, and gives it its beautiful variety of colours; also the black or brownish mucous which covers the anterior surface of the choroid membrane contiguous to the retina and the interior surface of the ciliary processes. (*See* EYE.) The word is also applied to colouring matters generally. (*See* PAINTING.)

PIKE, *pike.*—A genus (*Esox*) of malacopterous fishes, including all the species of the family *Esocidæ*. The generic characters of this fish are—head depressed, large, oblong, blunt; jaws, palatine bones, and vomer, furnished with teeth of various sizes; body elongated, rounded on the back; sides compressed, covered with scales; dorsal fin placed very far back over the anal fin. The common pike (*E. lucius*) is a well-known inhabitant of the principal rivers and lakes of Europe, and has long been common in many of the rivers, and almost all the lakes and ornamental waters of Great Britain, where, in the Middle Ages, it was held in high estimation; its value in the 13th century, for instance, being estimated at ten times that of the best turbot or cod. The pike is strong, fierce, and active; swims rapidly, and occasionally darts along with the rapidity of lightning. The spawn is deposited among weeds early in April; and at this season the spawning fish is found in narrow creeks and ditches connected with the larger waters they at other times inhabit. The colour is a dusky brown on the upper parts, and lighter and mottled with green and yellow on the sides. The tail fin is forked, and the larger fins are mottled with white, yellow, and dark green. The young are said to reach the length of eight to ten inches the first year, twelve to fourteen the second, eighteen to twenty inches the third, and there are proofs on record that from this last size the pike, if well supplied with food, will grow at the rate of four pounds' weight a year for six or seven successive years. One of the chief characteristics of the pike is its extraordinary voracity, anecdotes respecting which are almost innumerable. In default of a sufficient number of other fishes to satisfy them, they will seize upon moor-hens, ducks, and, indeed, any animals of small size, whether alive or dead; and it is by no means unusual for them to destroy themselves by endeavouring to swallow prey too large for their throats. They are also remarkable for their length of life and the great size they frequently attain. They are known to reach, in some instances, the age of a hundred years; and pike of sixty or seventy pounds' weight, although not common, are by no means extraordinary. The flesh of the pike is of good quality. It is caught with nets, rods, and set lines. November is the best month for catching it. A young pike is frequently called a Jack; and the Scotch name is Gedd. Luce is an old English name.

PIKE-PERCH.—A genus of fishes (*Lucioperca*), belonging to the Perch family, but resembling the pike in form, large mouth and powerful teeth. It is common in the Danube, and in most of the rivers and lakes of the north-east of Europe. Its flesh is much liked; and, salted and smoked, forms a considerable article of trade. A similar species (*L. Americana*) is a native of North America.

PILCHARD, *pil'-tshard.*—The name of a fish (*Clupea Pilchardus*) belonging to the family of the *Clupeidæ*, and much resembling the herring, but now considered to be identical with the sardine. It is about nine inches in length, with large scales; the back is bluish, and the sides and belly silvery; the head is compressed, and the mouth without teeth. The upper angle of each of the gills is marked with a large black spot. On the coast of Cornwall pilchards are found through all the seasons of the year; but in January they keep near the bottom, and, although in March they sometimes assemble in great numbers, it is not until July that they regularly and permanently congregate. The season and the situation for spawning, and the choice of food, are doubtless the chief causes which influence the motions of the great bodies of these fish; and when these are thoroughly known, the variations which have been noticed in the actions of the pilchard will probably no longer be a mystery. The pilchard feeds with voracity on small crustaceous animals, and especially on a minute species of shrimp, not larger than a flea. It is probable, also, that they devour the roe of fish. When the pilchards assemble off the Cornish and Devonshire coast, they resemble, says Mr. Yarrell, a mighty army with its wings stretching parallel to the land, and the whole composed of numberless smaller bodies, which are perpetually joining together, shifting their position, and separating again. The fishery for pilchards, which commences in July, and continues until the short days and stormy weather of the equinox, render its prosecution impracticable, is carried on by drift or driving nets, and with seans; the former consisting of a number of nets, commonly about twenty, each from eighteen to twenty fathoms long and seven fathoms deep, and sometimes reaching three-quarters of a mile. The fishery begins a little before sunset, and the nets are drawn in about two hours, to be again shot as morning approaches, pilchards entering the nets better at these seasons than at others. The number of fish taken by a drift-boat varies exceedingly. From 5000 to 10,000 is considered moderate; but the number often amounts to 20,000. 150,000 is considered a fair number for the season's fishing. As an object of adventure, the pilchard fishery is popular in Cornwall, and the inhabitants are greatly benefited by it. Immense quantities are exported to the West Indies and other places, and a large amount of capital is invested in the fisheries. The fish for export are pickled and the oil expressed, being afterwards, with the blood, used as manure. Since the reign of Elizabeth, the pilchard fishery has been regulated by Act of Parliament. In Scotland the pilchard is known as the Gipsy Herring.

PILES. (*See* HÆMORRHOIDS.)

PILEUS, *pi'-le-us.* (*See* FUNGI.)

PILEWORT, *pile'-wort.* (*See* RANUNCULUS.)

PILOT FISH.—The popular name of *Naucrates ductor*, a fish of the family *Scomberidæ*. It is about 12 inches long, of a silvery, greyish-blue colour, with fine dark-blue transverse bands. Its flesh resembles that of mackerel. It is common in the Mediterranean; and as it is often seen in the company of sharks, sailors believe that it pilots or leads them to their prey. It has a strange habit of following a ship, and has been known to do so for several thousand miles. A larger species is met with on the coasts of South America.

PIMENTO. (*See* EUGENIA.)

PIMPERNEL, *pim'-per-nel.*—A genus of plants (*Anagallis*), of the natural order *Primulaceæ*, small annual and perennial plants, natives chiefly of temperate climates. The Scarlet Pimpernel (*A. arvensis*) is common in this country, growing wild in fields and gardens. The flowers are scarlet, with a purple circle at the eye. A blue variety is comparatively rare in this country, but common in some parts of Europe. Several species are cultivated in flower-gardens. The scarlet pimpernel has been employed as a medicine in cases of dropsy and epilepsy.

PIMPINELLA, *pim'-pi-nel-la.*—In Botany, a genus of *Umbelliferæ*. The species *P. Anisum* is the anise so much esteemed for its carminative fruits or seeds. (*See* ANISE.)

PINACEÆ, *pi-nai'-se-e* (Lat., *pinus*, the pine). (*See* CONIFERÆ.)

PINE.—A genus (*Pinus*) of coniferous trees, distinguished from allied genera by the male catkins being crowded and racemose, and by the scales of the cones being thickened and angular at the end. Several species are valuable timber trees, as *P. sylvestris*, the Scotch fir, which yields the timber known as Dantzic or Riga fir and Russian deal; *P. strobus*, yielding the white pine or deal of the United States; *P. mitis* and *palustris*, yielding the yellow pine or deal; *P. rigida*, *P. Lambertiana*, and many more. Pine timber is used to an enormous extent in this country and elsewhere for house-carpentry, joinery, &c. Many valuable products besides timber may be traced to this genus. *P. sylvestris*, the Scotch fir, or wild pine, is the source of common turpentine; this yields, by distillation, the useful liquid known as oil, spirits, or essence of turpentine. When subjected to destructive distillation, the wood yields wood-tar and pitch. The inner bark is used in Norway for making the remarkable alimentary substance called bark-bread. From the leaves of this species the fleecy substance termed pine-wool, or fir-wool, is prepared; it is used for stuffing mattresses, and is considered to be repulsive of vermin. *P. pinaster*, or *maritima*, the cluster-pine, yields Bordeaux turpentine, galipot tar, and pitch. North America produces many species of pine, some of great beauty and value, especially the Red Canadian Pine (*P. resinosa*), a lofty and beautiful tree, and the Yellow Pine (*P. variabilis*), the timber of which is in great request for ship-building, and known in this country as the New York Pine. *P. palustris*, the swamp or long-leaved pine (known in trade as Georgia pitch-pine), furnishes the greater portion of the turpentine, tar, &c., consumed in the United States, or exported thence to other countries. *P. tæda*, the frankincense-pine, also yields turpentine. *P. pinea*, the stone-pine, has edible seeds, which are used as a dessert under the name of pine-nuts. *P. cembra*, the Siberian stone-pine, has also edible seeds; its young shoots, on being distilled, furnish the so-called Carpathian balsam. *P. pumilio*, the mugho or mountain pine, yields, by spontaneous exudation, anoleo-resin, called Hungarian balsam. *P. geradiana*, a native of Thibet and Afghanistan, has seeds which are edible. *P. longifolia*, which flourishes in the Himalayas, yields a remarkably fine turpentine.

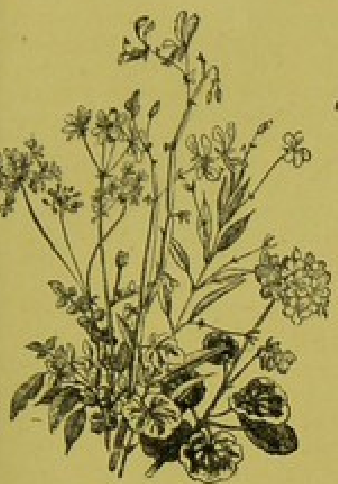
PINE-APPLE, OR ANANAS, *a-na'-nas.*—A plant (*Ananassa sativa*) of the natural order *Bromeliaceæ*. It is a native of South America, but is naturalized in many parts of Asia and Africa. The delicious flavour of the fruit has caused it to be carefully cultivated; and in this country pine-apples of superior flavour to the finest grown in the West Indies are reared in hothouses, and pine-apples weighing ten or twelve pounds are frequently obtained. On the summit of the fruit is a tuft or crown of small leaves, capable of becoming a new plant, and generally used for planting, as, in a high state of cultivation, seeds are rarely produced. Fruit is ordinarily obtained about sixteen or eighteen months after the planting out of the crown or suckers. Many varieties are cultivated. The fibre is valuable. (*See* BROMELIACEÆ.)

PINE-BEETLE, OR CHAFER.—A small coleopterous insect (*Hylurgus piniperda*) of the family *Xylophagi*, very destructive to the pine-tree.

PINE-FINCH.—A genus of birds (*Corythus*) of the family *Fringillidæ*, nearly allied to the bullfinch and crossbill. The common pine-finch (*C. enucleator*) is abundant in the northern parts of Europe, Asia, and America, but rarely visits this country. It is larger than the bullfinch, and the general colour of the male is red. It frequents pine forests, and has a full, rich song.

PINEY TREE. (*See* CALOPHYLLUM.)

PINGUICULA, *pin-gwik'-u-la.*—A genus of small plants, popularly known as Butterwort, of the natural order *Lentibulariaceæ*, found in bogs and marshes. Some of the species have beautiful flowers, especially *P. grandiflora*, a native of Ireland and the south of France. The Common Butterwort (*P. vulgaris*) has the property of coagulating milk, and is abundant in the northern parts of Britain and the continent of Europe. This property may have originated the name, but some authorities trace it to the slimy surface of the leaves.



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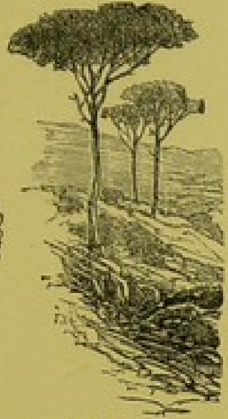

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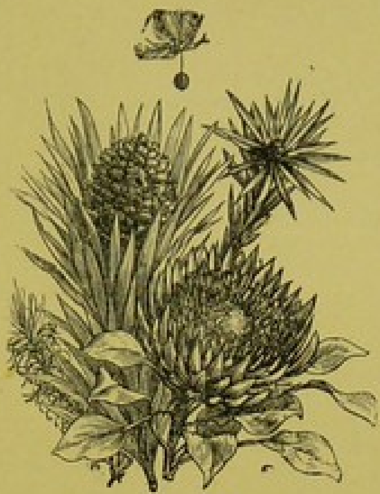


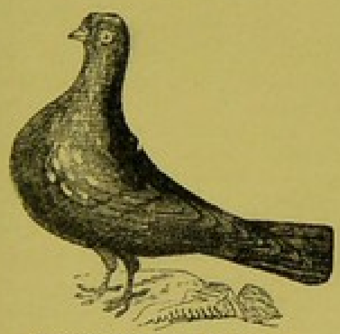
PROTEACEA

PAPYRUS.

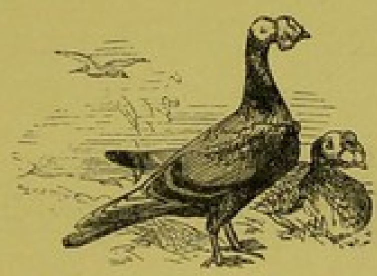
PODARGUS.

PEACH.

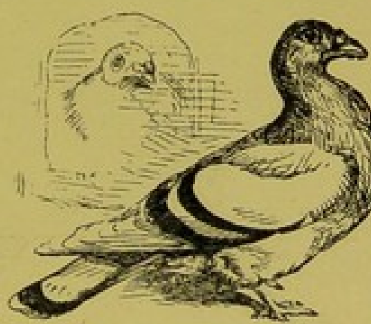
PARRAKEET.



BLACK MOTTLED TUMBLER



CARRIER-PIGEON.



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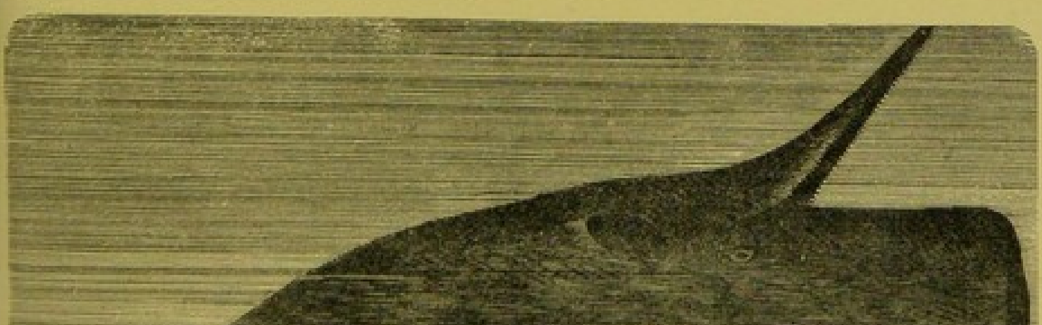

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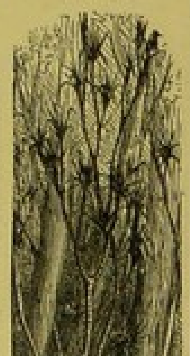


PANAUNACÆ.

PINK. (*See* DIANTHUS.)

PINNA, *pin'-na.*—A genus of lamellibranchiate molluscs, of the *Aviculidæ*, or pearl-mussel family. *P. nobilis*, a native of the Mediterranean, is the best known species. The shell is sometimes more than 20 inches long. The filaments of the byssus (which *see*) are in cases two feet long, and were used by the ancients, and still to a small extent in Sicily, for making fabrics, being very strong and lustrous. The animal is eaten.

PINTAIL DUCK.—A genus of ducks (*Dafila*), the male of which has a long tail tapering to a point, whence the name. The bill is narrow and without tubercle at the base. The Common Pintail (*D. acuta*) is rather larger and more graceful in appearance than most ducks, has a brown head with a white line on each side, extending down the neck; there are waving lines of black and grayish white on the back and sides, the lower parts are white and the central tail-feathers black. It is found in all the northern regions, and migrates southward in the winter, as far as the Mediterranean and the Gulf of Mexico. The flesh is very delicate.

PIP, OR ROUP.—A disease of poultry, frequently fatal to young birds. It most commonly occurs in cold or wet weather, and is exhibited by difficulty in breathing, an offensive discharge from the nostrils and eyes, rattling in the throat, and the formation of scales of hardened mucus on the tongue. Some poultry-keepers administer castor-oil, and pills made of sulphate of iron and capsicum, followed by a compound of sulphate of iron, cayenne pepper and butter. Washing the eyes, nostrils, and mouth with vinegar is also recommended. The birds affected should be kept warm, fed on oatmeal mixed with ale and green food.

PIPE-CLAY.—A fine clay, chiefly obtained from Devonshire, and the neighbourhood of Poole, in Dorsetshire, in this country; and found also in Belgium and some parts of Germany. It is of a grayish-white colour, and free from iron and other impurities, is plastic and infusible. These properties adapt it for the manufacture of clay-pipes and pottery. It is also used for the purpose of removing grease, and by soldiers for cleaning white accoutrements.

PIPE-FISH (Gr., *syn*, together; *gnathos*, a jaw).—A genus (*Syngnathus*) of osseous fishes of the order *Lophobranchii*. The form is long, the body almost covered with partially ossified plates, and the jaws are elongated so as to form a tubular snout. The Great Pipe-Fish (*S. acus*) is the most common species found on the British coast. It is generally from 12 to 15 inches in length, but is supposed in some instances to attain a much greater length. The male has a pouch on the tail, to which it is said the young retreat on the appearance of danger.

PIPER, *pi'-per* (from Gr., *pipto*, I digest; because it promotes digestion by its stimulating qualities).—The typical genus of the natural order *Piperaceæ*. (*See* PEPPER.)

PIPI, *pi'-pi.*—The ripe pods of *Cæsalpinia Papai*, used in tanning, and frequently used to adulterate divi-divi. (*See* CÆSALPINIA and DIVI-DIVI.)

PIPING CROW. (*See* BARITAH.)

PIPIT, *pi'-pit.* (*See* TITLARK.)

PIPPIN.—A name given to several varieties of apple, including some of the finest, as the Ribston and Golden pippins.

PIRAYA *pi-rai'-a.* (*See* SERRASALMO.)

PISALITE, *pe'-so-lite* (Lat., *pisum* pea).—A concretionary limestone, the particles of which are about the size of peas, larger than these of the oolite, which in other respects it resembles.

PISTACIA, *pis-tai'-she-a.*—A genus of the natural order *Anacardiaceæ*. The concrete resin called *mastic*, much used, dissolved in alcohol or turpentine, as a varnish and cement, is obtained from the species *P. Lentiscus*. (*See* MASTICA). *P. vera* produces the fruit known as *pistachio* or *pistacia nut*, the kernels of which are of a green colour and have a very agreeable flavour. They are highly esteemed by the Turks and Greeks, and are occasionally imported into this country.

PISTIACEÆ, OR LEMNACEÆ, *pis-te-ai'-se-e.*—The Duckweed family, a natural order of *Monocotyledones*, sub-class *Petaloideæ*. They are floating aquatic plants, inhabiting cool, temperate, and tropical regions. Their properties are unimportant.

PISTIL, OR GYNŒCIUM, *pis-til ji-ne'-se-um* (Lat., *pistillum*; Gr., *gune*, a woman).—The female system of the flower, or the *ovary*, *style*, and *stigma*, taken together. It occupies the centre of the flower, the stamens and floral envelopes being arranged around it, when they are present; the envelopes alone in the unisexual pistillate flower; or it stands by itself when the flower is pistillate and naked. It consists of one or more modified leaves called *carpels*, which are either distinct from each other, as in the columbine and stone-crop, or combined into one body, as in the primrose and tobacco-plant. When there is but one carpel, as in the pea, the pistil is said to be *simple*; when there is more than one, as in the examples cited above, it is *compound*. Each carpel consists essentially of a hollow inferior part called the *ovary* which contains the *ovules*, and a cellular part called the *stigma*, to which the *pollen*, or fertilizing dust from the *anthers*, adheres. The stigma is either placed directly on the ovary, in which case it is said to be *sessile*, as in the barberry, or it is elevated on a stalk prolonged from the ovary, called the *style*, as in the primrose. At the period of fecundation, the stigma becomes moistened by a viscid fluid, which renders the surface more or less sticky, and thus admirably adapted to retain the pollen-grains, which are thrown upon it at the time of the dehiscence of the anther. The style is traversed by a very narrow canal, which communicates below with the cavity of the ovary, and above with the stigmas. The walls of this canal are formed of a loose humid tissue, called the *conducting tissue*, from its fuction of conducting the pollen to the ovules. The terms *apocarpous*, *syncarpous*, *&c.*, are used, when describing the pistil, in the same sense as when they are applied to the fruit, which is in fact the mature pistil. (*See* CARPEL, FRUIT, OVARY, OVULE, and PLACENTA.)

PISUM, *pi'-sum.* (*See* PEA.)

PITCHBLENDE, *pitch-blend.*—A mineral of a brownish-black colour, which, when fused by the blowpipe, forms a dull yellow glass. It is essentially the same as oxide of uranium. (*See* URANIUM.)

PITCHER-PLANT. (*See* NEPENTHACEÆ.)

PITCHSTONE (German, *pechstein*).—A variety of felspar, exhibiting great variety of colour and having a slightly resinous appearance. When it contains embedded crystals of felspar, it is known as Pitchstone porphyry. The name is sometimes given to an inferior variety of common opal, having a resinous lustre.

PITCHURIM BEANS, *pitsh'-u-rim.*—The seed-lobes of a tree, *Nectandra Puchury*, a native of the alluvial districts of the valley of the Amazon, South America. They are about an inch and a half long. The names Sassafras Nuts, from the flavour, and Wild Nutmegs are also given. They are used in this country for flavouring chocolate, as a substitute for vanilla.

PITH.—The light cellular substance which occupies the centre of the stem and branches of exogenous plants.

PITTOSPORACEÆ, *pit-tos-po-rai'-se-e* (Gr., *pitta*, pitch; *sporos*, seed).—A natural order of *Thalamiflorous Dicotyledones*, chiefly Australian plants, but are occasionally found in Africa and some other parts of the globe. There are nearly 100 known species. They are remarkable for resinous properties. Some, as certain species of *Billardiera*, have edible fruits, and some are cultivated in this country on account of the beauty of their flowers. Some of the most graceful greenhouse climbers belong to the genus *Sollya*.

PITYRIASIS, *pit-e-ri'-a-sis* (Gr., *pityron*, bran).—A disease of the skin, in which there is a continual throwing off of bran-like scales of epidermis. When on the scalp, it is known as dandriff. One of the best remedies is the application of a watery solution of sulphurous acid gas.

PLACENTA, *pla-sen'-ta* (Lat., cake).—A temporary organ developed within the uterus of the mammalia during pregnancy, and expelled shortly after the birth of the offspring. It is popularly known as the afterbirth. It is a spongy vascular mass in the human being, about six or seven inches in diameter, and about an inch thick. Through the placenta the maternal blood is conveyed to the infant in the womb, and it also secretes the saccharine matter known as glycogen, which probably assists to keep up the animal heat. In woman the placenta acquires its proper character in the course of the third month, and goes on increasing to the full period of gestation.

In Botany, a projection on the inner wall of the ovary, to which the ovules, or rudimentary seeds, are attached.

PLACOID FISHES, *plak'-oid* (Gr., *plax*, plate; *eidos*, form).—An order of fishes having irregular plates of hard bone placed near together in the skin. In some cases these plates, or scales, are of large size; in others, as the dog-fish, they are only small tubercles. There are more fossil than living species.

PLAGIOSTOMI, *plag-ji-os'-to-me* (Gr., cross-mouthed).—An order of fishes containing the cartilaginous fishes with placoid scales. They have five or more gill-openings, but no air-bladder. Sharks and the other rays belong to one of the sub-orders.

PLAGUE, *plaig* (Gr., *plage*, a stroke).—A contagious fever, generally of a very severe kind, rapid in its progress, and accompanied by buboes, carbuncles, and petechiæ. It spreads rapidly by contact, and is usually fatal to two-thirds of those whom it attacks. The first symptoms are headache in the forehead and occiput, sometimes accompanied by violent and short tremors, alternating with heat. The eyes become red, and assume a ferocious aspect; the headache increases, and the pain extends to the spine, to the joints, and to the limbs. Then follow vertigo and delirium, at first mild, but afterwards fierce. The tongue is dry and yellowish, but without thirst. There is nausea, with ineffectual attempts, in most cases, to vomit, or if anything is brought up, it is green bile. The respiration is laborious, with general uneasiness. As the disease advances, the evacuations are loose, dark-coloured, and frequently bloody. The urine is often turbid, with an oily aspect. The smell of the patient is occasionally nauseous; but if the disease has lasted a few days, the perspiration has often a sweetish, disagreeable smell. The disease varies in duration from three to seven days; but the patient often dies within a few hours of the attack. Some die at periods from three to four days, without any outward symptoms beyond a peculiar physiognomy, sparkling eyes, and an expression of countenance resembling that of a person under hydrophobia. On dissection, the gall-bladder has been found distended with greenish-black bile, the inside of the intestines and stomach covered with a yellow mucus, and the conglobate glands indurated; but dissections have not, for obvious reasons, been numerous. The medical treatment of the plague has hitherto been of an empirical character; no treatment attempted having been proved to be of real use. It is most prevalent in the warmer and temperate regions, is well known in tropical climates, and the cold weather of the north has been observed to check its ravages. In Europe it has always been most fatal in summer and autumn. The plague is of Egyptian origin; the great plague of Athens, which took place 430 B.C., and which is the first instance on record of its appearance in Europe, having been imported from the borders of that country by a circuitous route through Libya. Its first introduction into modern Europe was by means of the Crusades, and it was known as the Black Death. (*See* BLACK DEATH.) Since then it has appeared in various places, and by many different courses, but always imported from some part or other of the Turkish empire. It has frequently appeared in London, where, in 1665, it destroyed 68,600 inhabitants, and extended to other parts. The Great Fire of London in 1666, occurring the year after the Great Plague, swept away the dirty and crowded buildings, and wider streets were constructed, with greater attention to drainage and other necessary matters. Quarantine laws, added to many improvements in the state of society, have protected Great Britain from its calamitous visitations. Various estimates have been given of the frequency of plague epidemics in the principal towns of Egypt, Syria, and Turkey; but the general opinion appears to be that it recurs, in those places, at intervals varying from seven to ten years; and that, whilst it is both endemic and contagious in Lower Egypt, from the marshy lands of which it springs, it is merely contagious in Upper Egypt, as well as in Syria, and all the more distant countries to which it may be conveyed. According to the general accounts, the plague would seem seldom to occur in Egypt in the months of September, October, November, December, and January;

but if it do begin in September or October, is more terrible than if it appear later. Whatever may be the immediate cause of outbreaks of the plague, it is scarcely to be doubted that a remote cause is the excessive filthiness of Oriental cities. Whether the plague is contagious, or whether, in case of recovery, there is a liability to a second attack, are still open questions. It is uncertain whether this particular disease is referred to in the Bible. Several Hebrew words are translated "plague" and "pestilence," but it is not clear that any of them designates the modern plague. Hezekiah's disease (2 Kings xx.) has been thought to be the plague, and its fatal nature, as well as the mention of a boil, makes this not improbable; but, on the other hand, there is no mention of a pestilence among the people at the time. Some of the most remarkable visitations of the plague have been that which occurred in Britain, A.D. 430, and which carried off such multitudes, that the living were scarcely sufficient to bury the dead; that which destroyed 200,000 of the inhabitants of Constantinople, A.D. 746. In Germany, 90,000 persons died of it in 1348; in Ireland, great numbers died of plague in 1466 and 1470; in London, 30,578 persons perished of plague alone in 1603-4, and 35,417 in 1625. The plague carried from Sardinia to Naples in 1656 (being introduced by a transport with soldiers on board) raged with such violence as to carry off 400,000 of the inhabitants in six months. In Egypt, more than 800,000 died of plague in 1792. In 1799, 3000 died daily in Barbary; and at Fez, 247,000 perished; and at Malta it committed great ravages in 1813.

PLAICE, *plaise* (Fr., *plie*; Sp., *platija*).—A fish (*Platessa vulgaris*) belonging to the family of the Flounders or Flat-fish (*Pleuronectidæ*), the characteristics of which are a want of symmetry in the form of the head; the position of both eyes on the same side of the head, one higher than the other, and frequently not in the same vertical line, and often unequal in size; the frequent want of uniformity in those fins that are in pairs; and the whole colour of the fish confined to one side, while the other side remains perfectly white. The plaice (as well as the flounder and the dab) is known from the other flat fish by each jaw having a single row of obtuse teeth, a spine at the beginning of the anal fin, and a rounded tail. Preferring muddy or sandy shores, and unprovided with swimming-bladders, the plaice generally keep close to the ground, where they hide their bodies horizontally in the loose soil at the bottom, with the head only slightly elevated, or swim slowly in the same position. The plaice spawns in February or March, and is considered to be in the finest condition at the end of May. Plaice feed on the soft-bodied animals generally, with young fish and soft crustacea, and have been known to attain a weight of fifteen pounds; but one of seven or eight pounds' weight is considered a plaice of large size. The body is smooth on both sides, the scales small; the colour of the upper or right side a rich brown, with a row of bright orange-red spots along the dorsal and anal fins, and other spots of the same colour dispersed over the body; the under side entirely white. Young fish have frequently a dark spot in the centre of the red one. On the English coast the plaice is taken in abundance, generally wherever either lines or trawl-nets can be used, and is sometimes taken in almost incredible numbers.

PLAIN. (*See* PHYSICAL GEOGRAPHY.)

PLANARIA, *plan-a'-re-a.*—A genus of worms inhabiting stagnant water, either salt or fresh, resembling the entozoic parasites. The body seems to be entirely gelatinous. Some can swim freely. If divided by cutting, each part continues to live and feel.

PLANE, *plain.*—A surface without curvature, or one that lies evenly between its bounding lines; and as a right line is the shortest extension from one point to another, so a plane surface is the shortest extension from one line to another. The term plane is frequently used in astronomy, conic sections, &c., to signify an imaginary surface supposed to cut and pass through all solid bodies; and the whole doctrine of conic sections is based on this foundation. In Mechanics, planes are either horizontal—that is, parallel to the horizon—or inclined to it. In Optics, the planes of reflection and refraction are those drawn through the reflected or refracted rays.

PLANET, *plan'-et* (Gr., *planetes*, a wanderer).—A term originally applied to those stars which have a perceptible motion. In modern Astronomy, however, the word is confined to those stars which shine by reflecting the light of the sun, around which they revolve. The larger, or *major planets* of the solar system are, in the order of distance from the sun, Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. (*See* various headings.) The moons or satellites, revolving round some of the planets, are sometimes described as *secondary planets*. A large number (about 220) of smaller planetary bodies are known as asteroids, or planetoids. (*See* ASTEROIDS.)

PLANT.—An organism having life, but no indication of mind or animal feeling—a vegetable. The science which treats of plants is known as Botany (which *see*).

Distribution of Plants. (*See* PHYSICAL GEOGRAPHY.)

PLANTAGINACEÆ, *plan-taj-i-nai'-se-e* (Lat., *Planta*, the sole of the foot; resemblance in the leaves).—The Ribworts, a natural order of *Dicotyledones*, sub-class *Corolliflora*—herbaceous plants, generally without stems. Leaves commonly ribbed, and radical. Flowers usually spiked and perfect, or rarely solitary, and sometimes unisexual. These plants abound in cold and temperate climates, but are more or less diffused over the whole globe. There are three genera and 120 species. The most important genus is Plantago, frequently named Plantain. The seeds of the *Plantago Psyllium*, *arenaria*, and *Cynops*, are demulcent, and have been used like those of flax (linseed) in the preparation of mucilaginous demulcent drinks.

PLANTAIN, *plan'-tain.*—An important food plant (*Musa Paradisaica*), belonging to the natural order *Musaceæ*. It is a large herbaceous plant, a native of India, but now cultivated in all tropical and subtropical regions. It was probably taken to America soon after the discovery of that continent, where it is now a most important product, being in some regions the chief article of food of the Indian population. The stem is generally from 15 to 20 feet in height; the leaves are very large, being sometimes 10 feet long and 3 feet wide. The fruit, nearly a foot long, is cooked, and in many instances form a substitute for bread. Baked or fired in slices with butter and sugar, the plantain is esteemed a great delicacy. A beverage is made from the fruit by decoction, and a kind of wine by fermentation.

PLANTAIN-EATER.—A genus of tropical birds (*Musophaga*), with beautiful plumage, in some respects allied to the finches, but larger. They have strong bills, with serrated cutting edges, with which the plantain and other fruits and the succulent stems of plants are divided. They are active birds, living much among the boughs of trees.

PLANTIGRADA, *plan-ti-gra'-da* (Lat., *planta*, sole of foot; *gradus*, step).—Animals characterized by placing the whole sole of the foot on the ground in walking. The bear is a conspicuous example. Many animals having this peculiarity are nocturnal in their habits, and their movements are slow and clumsy. They are rarely carnivorous, and most of them can assume an erect position.

PLASMA, *plas'-ma*.—A silicious mineral of a dark green colour, a variety of quartz or chalcedony, and nearly allied to heliotrope or bloodstone. It is very rare, and the finest specimens are brought from India and China. The Romans made ornaments from it, and fine engraved specimens are preserved.

PLATALEA, *pla-ta'-le-a*. (*See* SPOONBILL.)

PLATANACEÆ, *plat-a-nai'-se-e* (Gr., *platanos*).—The Plane family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*. They are trees or shrubs with a watery juice. The Planes are chiefly natives of America and the Levant. Being large, handsome trees, they are commonly grown in our parks and squares. The leaves in form resemble those of the sycamore-tree, or mock-plane (*Acer pseudol-platanus*). There is only one genus, *Platanus*, and very few species. They are natives of temperate climates, have smooth, whitish bark, which annually scales off in large pieces. The catkins are pendulous, with long stalks. The Oriental Plane (*P. orientalis*) was cultivated as an ornamental tree by the Greeks and Romans, and it was the principal tree in the renowned grove of Academus. In the south of Europe it is planted for shade and ornament, and endures better than any other tree the atmosphere of a large city. The wood is of value for cabinet-making, is fine grained, and takes a high polish. The North American Plane, or Button-wood (*P. occidentalis*), is the largest deciduous tree in the United States. Specimens more than 100 feet high are known.

PLATINUM, *plat'-i-num* (Sp., *platina*, from *plata*).—A valuable metal found in nature in small flattened grains, alloyed, more or less, with palladium, rhodium, osmium, ruthenium, and iridium; but pieces of a much larger size have occasionally been met with. It occurs chiefly in certain of the alluvial districts of Mexico, Brazil, and the Ural Mountains. Platinum, or platina as it was formerly called, from a Spanish word signifying little silver, is a white metal possessing properties which render it most valuable in the arts. It is susceptible of a high lustre, and possesses considerable hardness. It is the most ductile of all metals, and is nearly as malleable as gold.

Chlorides of Platinum.—There are two chlorides of platinum—the protochloride and the bichloride. To obtain the former, the solution of platinum in aqua regia is evaporated and the residue exposed to a heat of 450° Fahr., until chlorine ceases to be expelled. It is an olive-green powder, insoluble in water, but dissolving easily is caustic potash. Bichloride of platinum is invaluable in organic chemistry in determining the formulæ of the artificial alkalies, by the formation of the double chlorides.

Oxides of Platinum.—There are two oxides of platinum—the protoxide and the binoxide. The protoxide is known only as a hydrate, obtained as a black powder, by decomposing the protochloride with potash. The anhydrous binoxide is obtained as a black powder by heating the hydrate, which is thrown down by adding excess of potash to bichloride of platinum, and decomposing the platinate of potash thus formed with acetic acid. The hydrate is a red-brown powder, resembling sesquioxide of iron, and playing the part of an acid and a base. With potash and soda, crystallizable platinates may be formed; while with nitric and sulphuric acids it forms the nitrate and sulphate of the binoxide.

Sulphides of Platinum.—Platinum forms two sulphides—the protosulphide and the bisulphide; but they are of no practical interest

PLATYPUS, *plat'-e-pus*. *See* DUCK BILL.)

PLATYSTOMA, *plat-e-sto-ma* Gr., broad-mouthed).—A genus of fishes of the family *Siluridæ*. There are many species, some of large size, mostly found in the rivers of South America. They have flat snouts and very large mouths. Some are very beautifully marked, with transverse streaks of black and white on the light blue of the body. The flesh is considered a great delicacy.

PLECTOGNATHI, *plek-to-na'-the*.—Fishes regarded as a connecting link between the osseous and cartilaginous fishes, the skeleton being less perfectly ossified than in osseous fishes generally.

PLEIADES, *pli'-a-deez*.—A group of stars in the constellation Taurus, of which six are visible to ordinary eyesight, though to those who have exceptionally good sight, 10 and even 14 stars are visible. The name is taken from the Greek mythological legend, that the seven daughters of Atlas, being pusued by Orion, were changed by Jupiter into doves, and afterwards translated to the heavens. Formerly seven stars were very prominent, but one has disappeared or changed its magnitude. The legend accounts for them by relating that one of the seven sisters hid herself for shame because she had married a mortal.

PLEIOCENE, *pli'-o-seen* (Gr., *pleion* more; *kainas*, new).—In Geology, a name given to a section of the Upper Tertiary strata. In this country they occur only in Suffolk, where they cover the upper beds of the London clay. They are divided into the Red Crag and the Coralline Crag, each averaging about 50 feet in thickness. The former consists of quartzose sands and gravel, with a mixture of shells with fossils of molluscs and teeth of Sharks and other large fish. The latter is a mass of shells and polyzoa, with occasional layers of limestone and coral-like masses. Pleiocene rocks are found in many parts of the continent of Europe.

Pleistocene, or newer Pleiocene, is the name given to the most recent Tertiary deposits, the oldest of which represent a time of intense cold, having been formed at the botton of a sea into which immense glaciers had drifted. The formation is represented in Britain by the glacial drift, or boulder formations of Norfolk, of the Clyde in Scotland, and of North Wales. Other examples are also to be found in the cave deposits of Kirkdale, about 25 miles from York. In one cave there were found the remains of 300 hyenas, belonging to individuals of every age. The remains of the mammoth belong to this period, and there is geological evidence that man is a contemporary of that huge animal. According to Dr. Buckland, they must have lived there. The remains of the ox, young elephant, hippopotamus, rhinoceros, horse, bear, wolf, hare, water-rat, and several birds, were also found. No less than thirty-seven species of mammalia are enumerated by Professor Owen as having been discovered in the caves of this period in the British Islands.

PLESIOSAURUS, *ple-se-o-saw'-rus* (Gr., *plesios*, near; *sauros*, a reptile).—The name given to a genus of extinct amphibious saurians, principally remarkable for their length of neck. Their remains are found in the lias, oolite, and cretaceous measures; but are most common in the lias and Kimmeridge clay beds. (*See* GEOLOGY.) They are closely allied to the *Ichthyosaurus*, and their general appearance must have been very hideous. The head was that of a monstrous lizard, furnished with teeth like those of a crocodile; its neck was of enormous length, resembling the body of a serpent; while the trunk and tail had the proportions of an ordinary quadruped, the ribs of a chameleon, and the paddles of a whale. The remains of more than 20 species of plesiosaurians have been found. The first remains were discovered at Lyme Regis in 1822.

PLETHORA, *pleth'-o-ra* (Gr., *plethora*, fulness).—A term employed by older medical writers to signify a superabundance of any of the fluids of the body, but, as now used, to express a redundancy of blood.

PLEURITIS, OR PLEURISY, *plu-ri'-tis*, *plu'-re-se* (Gr., *pleuron*, the side).—Inflammation of the pleura, or investing membrane of the lungs. (*See* LUNGS.) Among the causes of pleurisy, the more common are exposure to cold, especially after violent exercise, blows on the chest, fracture of the ribs, tubercles in the lungs. It is most prevalent in winter, and, next to that, in autumn. Old persons are most subject to it, but it may occur at any period of life. It is usually distinguished as acute and chronic. The former usually commences with chills, rigours, and the ordinary symptoms of inflammatory fever, accompanied or followed by a sense of weight in the chest, which in a few hours becomes acute pain, usually referred to a point directly below the nipple. There is usually a short dry cough, and the breathing is frequent, short, and anxious; the pain being increased by a deep inspiration or the act of coughing. In the treatment of this disease, the object is to reduce the local inflammation and prevent effusion. In chronic pleuritis the symptoms are usually those of the acute form in a mitigated state. It may succeed the acute, or it may come on gradually without any of the more marked features of that disease. There is usually more or less of fever, an acceleration of the pulse, emaciation, difficulty or hurry of breathing, increased by exertion, more or less of pain or soreness, and inability to lie on the healthy side. The treatment of this form of the disease differs from that of the other, the object being to promote the absorption of the effused matter, and also to support the patient's strength. The general health is to be improved by a nutritious, but not heating or stimulating diet, and by the cautious exhibition of such tonics as the strength of the patient is able to bear. Change of air will often be found to act most beneficially in such cases, and is frequently found to be efficacious when most other remedies have failed. When other means fail, recourse is sometimes had to the operation of *paracentesis thoracis* for setting free the effused matter; but the operation is attended with considerable danger and is rarely productive of more than a temporary relief.

PLEURISY ROOT. (*See* BUTTERFLY WEED.)

PLEURODYNIA, *plu-ro-di'-ne-a.*—A rheumatic affection of the intercostal muscles, marked by great pain in the side and tenderness on pressure. It generally yields to counter-irritation, as the application of liniments or blistering, and other local treatment.

PLEURONECTIDÆ, *plu-ro-nek'-ti-de.*—A family of fishes, popularly known as flat fishes marked by the peculiarity of a want of symmetry in the head, and of swimming with one side uppermost, both the eyes being situated on the uppermost side. They have no air-bladders. The turbot, halibut, brill, plaice and flounder belong to this family. (*See* MALACOPTERYGII.)

PLEURO-PNEUMONIA, *plu-ra-nu-mo'-ne-a.*—A contagious disorder very fatal to cattle, consisting in a sub-acute inflammation of the structure of the lungs and their investing membrane, accompanied by low fever. (*See* CATTLE PLAGUE.)

PLICA, POLONICA, *pli-ka, po-lo'-ni-ka.*—A disease of the scalp, producing a matting together of the hair by a fetid secretion. It is very prevalent in Poland, whence the name. It is produced by a fungus of the genus *Trichophyton.*

PLIOCARIA. (*See* GRACILLARIA.)

PLOCEUS, *plo-se'-us.* (*See* WEAVER BIRD.)

PLOVER, *pluv'-er* (Fr., *pluvier*, the water-bird).—The common name of several species of birds that frequent the banks of rivers and the sea-shore, belonging to the genus *Charadrius.* One species, known by the names of the Great Plover, Norfolk Plover, or Stone Curlew, is a summer visitor to this country, arriving here in April, and leaving again at the end of September or in October. As it comes from the south, it is much more numerous in the southern and south-eastern counties of England than far to the west or to the north; but its powers of wing allow it a wide range of flight. Their breeding-season commences about the second week in April, the female depositing its pair of eggs upon the bare ground, without any nest whatever. The eggs are pale clay-brown, blotched, spotted, and streaked with ash-blue and dark brown, two inches two lines in length, by one inch seven lines in breadth. The large and prominent eye in this species indicates a bird that moves and feeds by twilight, or later. Their food is worms, slugs, and insects; and they are also believed to kill and devour small mammalia and small reptiles, their stout frame and large beak being sufficiently powerful to enable them to do so. The great plover annually visits Germany, and is abundant in France, Spain, Italy, and southward to Africa, Madeira, and even to Southern Africa; eastward it is found in Corfu, Turkey, and the Grecian archipelago. It has also been found on the plains between the Black and Caspian seas and in India. Its generic characters are, a strong, straight, stout beak, a little depressed at the base; nostrils placed in the middle of the beak, extending longitudinally as far forward as the horny portion, open in front, pervious; legs long, slender; three toes only, directed forwards, united by a membrane as far as the second articulation; wings moderate; second quill-feather the longest in the wing; tail graduated. In the adult bird the top of the head and back of the neck are a pale wood-brown, each feather with a streak of black in the centre; the feathers of the back, wing-coverts, tertials, and upper tail-coverts, pale brown, each feather with a dark, brownish-black, longitudinal streak in the line of the shaft; the tail-feathers with the basal halves mottled with two shades of brown, the third portion white, the ends black. The chin and throat white; the neck and breast brownish-white; belly, sides, and flanks, almost white. The whole length is seventeen inches; the wing, from the carpal joint to the end, nine inches and three-quarters. The golden plover (*Charadrius pluvialis*), which is considered by ornithologists to be the true plover, is a bird of great powers of flight, and has, consequently, great geographical range. It is found during summer breeding on the high hills and swampy grounds of the north of England and Scotland. It lays four eggs, which are large in proportion to the size of the bird, and very handsome, of a yellowish stone-colour, spotted and blotched with brownish-black; the length two inches, by one inch four lines in breadth. The nest is but slightly constructed, a small depression in the ground amidst the heath being usually taken advantage of, and lined with a few dry fibres and stems of grass. The adult bird in its summer plumage has the beak black; the irides very dark brown, almost black; on the forehead a band of white; the top of the head, the nape of the neck, the back, wing-coverts, grayish-black; the edges of all the feathers varied with triangular-shaped spots of gamboge-yellow; the wing-primaries almost black; tail-feathers obliquely barred with shades of grayish-white and brownish-black; the lore, chin, sides of the neck, throat, breast, and all the under surface of the body jet-black, bounded on the sides with a band of white below the wing; axillary plume elongated, and pure white; under tail-coverts white. The whole length of the bird is about eleven inches. The gray plover (*S. cineria*) is a winter visitor to Britain, is rather larger than the golden plover. There are several American species. The flesh and eggs of the plover are much prized by epicures.

PLUM. (*See* PRUNUS.)

PLUMATELLA, *plu-ma-tel'-la.*—A genus of zoophytes (*Polyzoa*), found in fresh water attached to stones and other solid matters. A common British species, *P. repens*, sometimes occupies a square foot of surface, having brands and tentacles beautifully feathered with cilia.

PLUMBAGINACEÆ, *plum-ba-jin-ai'-se-e* (from Lat., *plumbum*, lead).—The Leadwort or Thrift family, a natural order of *Dicotyledones*, sub-class *Corollifloræ*. They are herbs, or under-shrubs, and are chiefly found growing on the sea-shore and in salt marshes, in various parts of the globe; but the majority inhabit temperate regions. There are about 160 species known, and the roots of some are acrid and vesicant when fresh, as those of *P. Europæa*, the tooth-wort, *P. zeylanica*, and *scandens*. *P. toxicaria* is used as a poison in Mozambique.

PLUMBAGO, OR GRAPHITE, *plum-bai'-go* (Lat., *plumbum*, lead).—A valuable mineral found in various parts of the world, the most remarkable deposit being at Borrowdale, in Cumberland. In colour, it is iron-black, or dark steel-gray, with a metallic lustre. It is combustible when subjected to a high degree of heat, leaving a residue of oxide of iron; but is infusible either alone or with fluxes.

PLUME-BIRD.—A genus of birds (*Epimachus*), of the family *Upupidæ*, and having a resemblance both to honey-suckers and birds of Paradise. They are natives of Australia and New Guinea. The plumage is very rich and beautiful, and the species are variously adorned with very long tail-feathers, tufts of broad feathers on the shoulders, and loose downy plumes. One species, *E. albus*, has very long thread-like prolongations of the shafts of some of the plumes.

PLUMED MOTH.—A group of lepidoptera, *Fissipennæ* and *Pterophorites*, popularly known by the name here given, because the wings are cleft longitudinally into two or more portions, each beautifully fringed at the edges. They are of small size, and very beautiful. Although generally classed as nocturnal, they may be seen in the brightest part of the day. Some of them fold up their wings like a fan.

PLUMALARIA, *plu-ma-la'-re-a.*—A genus (*Anthosoa*) of plant-like zoophytes, with feathery shoots and offsets. There are many species, marine, and some very common on the British coasts, where they are found attached to stones, shells, and sea-weeds, and form very beautiful objects. Examined by the microscope, a single specimen of *P. falcata*, a common British species, occupying a space about two inches square, will be found to have from 80,000 to 100,000 polypes.

PLUTONIC ROCKS, *plu-ton'-ik* (Gr., *Plouton*, the god of the infernal regions).—A geological name for granite rocks supposed to have been formed at a great depth below the earth's surface, and which have cooled and crystallized slowly under great pressure. (*See* GEOLOGY and GRANITE.)

PNEUMATICS, *nu-mat'-iks* (Gr., *pneuma*, air).—That branch of physical science which treats of the mechanical properties of elastic fluids, and principally of atmospheric air. To a certain extent, the mechanical properties of the air seem to have been known to the ancients. Not only does Aristotle mention that a bladder filled with air weighs more than when it is empty, but Ctesibius, who lived 130 B.C., appears to have invented a species of forcing-pump for raising water, and of instruments for producing sound by the passage of air through orifices in tubes. These inventions are proof that the elastic force of compressed air was then comprehended. For a long time the ascent of water in pumps, upon raising the piston, was ascribed to nature's abhorrence of a vacuum. When, however, it was found that the height of the column of water raised never exceeded a certain quantity —about thirty-four feet—this idea was gradually exploded. The explanation of the true cause of the phenomenon—the vacuum between the piston and the surface of the column, and the pressure of the atmosphere on the external water—was first determined by Torricelli; and the same philosopher also calculated the pressure of the atmosphere by the weight of the column of mercury supported in a tube closed at the upper extremity (the barometer.) The next result of the study of pneumatics was the discovery of the thermometer, soon after the commencement of the 17th century. Steam began to be used as a moving power for pumps and other machinery in the beginning of the 18th century. The law of the resistance of the air to bodies moving in it was first discovered by Sir Isaac Newton; but the intensity of this resistance against military projectiles was first determined for the inferior projectiles by Robins, in 1740. Boyle and Mariotte gave great attention to the subject in the 17th century. Dr. Hutton afterwards obtained a formula, which is sufficiently correct for any velocity. Robins, Euler, and Hutton, by their researches, determined the expansion of fired gunpowder; and that of steam was investigated by Dalton in England, and Prony and Arago in France.

PNEUMOGASTRIC NERVE, *nu-mo-gas'-trik.*—The nerve issuing from the medulla oblongata (*see* BRAIN), which supplies the lungs and stomach with nervous filaments. This is a "mixed nerve," containing filaments both of sensation and motion. Both in the pulmonary and gastric branches it is very sensitive, and pressure or injury give rise to various affections of the throat and digestive organs.

PNEUMONIA, *nu-mo'-ne-a* (Gr., *pneumon*, the lung).—Inflammation of the substance of the lungs. It may be occasioned by any of the causes which produce inflammation in general,—vicissitudes of temperature, the application of cold, violent exercise of the body, exertions of voice, &c. It occurs most frequently in the winter and spring months. It is characterised by fever, difficulty of breathing, cough, dryness of the skin, heat, anxiety, thirst, and a sense of weight and pain in the chest. The pain is dull, deep-seated, and rarely acute, unless the pleura be likewise affected. At first the cough is frequently dry and without expectoration; but after one or two days matter is brought up, viscid and rusty-coloured, and often streaked with blood. In favourable cases, this disease may decline on the third or fourth day, but more frequently it is protracted to ten days or a fortnight. In unfavourable cases the symptoms increase on the third or fourth day, and become more and more aggravated, until at length the patient dies exhausted or asphyxiated. A high degree of fever, attended with delirium, great difficulty of breathing, acute pain and dry cough, denote great danger; while, on the contrary, an abatement of the febrile symptoms and of the difficulty of breathing and pain, taking place on the coming on of a free expectoration, or other critical evacuation, promise fair for recovery. It is sometimes said that persons die from rapid consumption, lasting only a few days. Such cases are almost invariably pneumonia—inflammation, not destruction of the substance of the lungs.

POA, *po'-a* (Gr., a genus of grasses).—The most important species is *P. Abyssinica*, an Abyssinian corn-plant, known by the native name of *teff*. The grains are sometimes employed in the preparation of *Bouza*, or millet beer.

POCHARD, *po'-kard.*—A genus of ducks (*Fuligula*), with broad flat, and long bills, short wings and a rounded tail. There are many species, some natives of the Arctic regions and some visiting in winter the coasts of Europe, Asia and North America. The Common Pochard (*F. ferina*), although a native of northern regions, migrates occasionally as far south as Louisiana in North America, and Bengal in Asia. It is well known as a winter visitor to Britain, where it is known as the Dun-bird, and as the Red-headed or Red-eyed Poker. In size it is rather larger than the wigeon; the head and neck are of a bright chesnut colour, and the eyes are red. The flesh is considered a great delicacy, and it fetches a good price in the London markets in winter. The Tufted Duck (*F. cristata*), another well-known visitor to this country, and the Canvas-back Duck (*F. Valisneria*), so much sought after in America, belong to this genus.

POD, OR LEGUME, *pod* (Sax., *pod*, a cover ing).—A superior one-celled, one, or many-seeded fruit, dehiscing by both the ventral and dorsal sutures, so as to form two valves, and bearing its seed or seeds on the ventral suture. Examples occur in the pea, the bean, the clover, and in most plants of the order *Leguminosæ*, which de rives its name from this character.

PODAGRA, *po'-da-gra.* (*See* GOUT.)

PODARGUS, *po-dar'-gus.*—A genus of birds nearly allied to the Goat-suckers mostly natives of Australia. They are nocturnal in their habits. From its peculiar cry, one species is known in Australia as "More Pork."

PODOCARPUS, *po-do-kar'-pus.*—A genus of trees of the natural order *Coniferæ*, sub-order *Taxineæ*, natives of the South Sea Islands and the Indian Archipelago. Some of them, especially *P. cupressina*, is a valuable timber-tree, the wood of which is of a yellowish colour, and takes on a fine polish. The Totarra Pine (*P. totarra*) of New Zealand is well-adapted for ship-building.

PODOPTHALMIA, *pod-o-thal'-me-a* (Gr., stalked-eyed).—A sub-class of Crustaceans, having stalked and movable eyes. They include crabs, lobsters, and shrimps.

PODOPHYLLUM, *pod-o-fil'-lum* (Gr., *pous*, a foot; *phullon*, a leaf, from the shape of its leaf).—A genus of the natural order *Ranunculaceæ*, or, according to American botanists, of a distinct order termed *Podophyllaceæ*. *P. peltatum*, the May-apple, or wild-lemon, is a common herb throughout the American States. Its fruit is a berry, about the size of an egg, of a light-yellow colour, and having a pleasant sub-acid taste. The Indians of North America have employed a decoction of the leaves and stalks for ages in diseases requiring a cathartic.

Podophyllin.—The resin obtained from the root of the May-apple. It is a greenish powder, and has been found to be a valuable medicine for relieving the liver by inducing copious bilious discharges; but its action is somewhat uncertain, varying in effect with different constitutions.

PODOSTEMACEÆ, *po-dos-te-mai'-se-e.*—The *Podostemon*, or River-weed family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*. They are aquatic herbaceous plants, having much the appearance of mosses and liverworts. There are 21 genera, including about 100 species, principally natives of South America. Some species of the genus *Lacis* are used for human food on the Rio Negro, and other plants of the order are eaten by cattle and fish.

PODURA, *po-du'-ra.*—A genus of small wingless insects of the order *Thysanoura.* They have their cylindrical bodies and tails divided into two branches at the extremity. The tail being bent beneath the abdomen, and suddenly extended, enables the insect to leap a considerable distance, and this power has given rise to the popular name, Spring-tail. The body is covered with scales, which are well-known test-objects for microscopes. There are many species, some found on leaves, and others under stones, and in damp places.

POGGE, *pog'-ge.*—A fish (*Aspidophorus Europœus*) of the family *Sclerogenidœ.* It is known to English fishermen as the Armed Bullhead, but differs from the Bullhead in having the body covered with large bony scales. In form it is nearly pyramidical. The length is about six inches; the flesh is good.

POGONIAS, *po-go'-ne-as.*—A genus of acanthopterous fishes, of the family *Sciœnidœ.* They are found on the coasts of all warm countries, and from a peculiar noise they make are known to sailors and fishermen as Drumfish. A characteristic of the genus is the possession of two dorsal fins, one deeply notched, and small barbels under the mouth. Some of the species are of very large size, weighing nearly a hundredweight. The flavour of the flesh is excellent.

POGOSTEMON, *po-go-ste'-mon* (Gr., *pogon*, beard; *stemon*, stamen). (*See* PATCHOULI.)

POINT, *point* (from Lat., *punctum*, from *pungo*, I prick).—A point in Geometry, as defined by Euclid, is that which has position but not magnitude. Hence, points are the ends or extremities of lines; and if a point be supposed to be moved any way, it will, by its motion, describe a line.

POINTER, *point'-er.*—This member of the canine family is a remarkable instance that the acquired propensities of the different varieties of dogs are transmitted from parent to progeny; for requiring, as it must have done, a long and persevering education to produce even a moderate approach to the excellence of the present breed of pointers, these sagacious dogs will now, almost without education, or, in technical phraseology, with very little breaking, exhibit a strong tendency to the peculiarity of their race, and stand at game of every kind, and that even when they are puppies. The peculiar characteristic of the pointer is, that he will stand motionless, as if converted into a statue, on coming into contact with the slightest scent of game. The pointer is probably originally a native of Spain, and the Spanish pointer was formerly well known as a stanch, strong, and useful, but heavy and lazy dog. The English breed, however, is now very much preferred, being exceedingly handsome, good-tempered, stanch, and patient of fatigue, and at the same time light and active in its appearance and habits. It is supposed to be crossed with the foxhound, which in many particulars it resembles. Pointers, about the middle of the 17th century, were scarcely ever to be seen but entirely white, or variegated with liver-coloured spots, except the then duke of Kingston's celebrated pack, which were black and white; they are now, however, to be met with of every description, from pure white and a kind of bluish-gray, to a universal liver-colour and a perfect black. Pointers are never considered complete unless they are perfectly stanch to bird, dog, and gun: which implies, first, standing singly to a bird or covey; secondly, to backing (or pointing instantaneously likewise) the moment they perceive another dog stand; and, lastly, not to stir from their point upon the firing of any gun in company, provided the game is neither sprung nor started at which the original point was made.

POISON, *poy'-zon* (Fr.).—Any substance which, when administered in small quantities, is capable of acting deleteriously on the body. In general language, however, the term is applied to those substances only which, when taken into the system, destroy life, unless the quantity is too small, or the destructive effect is rendered negatory by admixture with other ingredients, as in medicinal preparations, in which matters in their nature poisonous are employed beneficially. The words of the statute on poisoning (1 Vic. c. 85, sec. 2) are very general, and embrace all kinds of substances, whether they be popularly or professionally regarded as poisons or not. Thus it is laid down that "whoever shall administer, or cause to be taken by any person, any poison, or other destructive thing, with intent to commit murder, shall be guilty of felony, and being convicted thereof, shall suffer death." Poisons have been divided into three classes, according to their mode of action on the system—namely, *irritants*, *narcotics*, and *narcotico-irritants*. The narcotics and narcotico-irritants may, however, be regarded as one large class—the *neurotics*, as their special action is to affect directly one or more parts of the nervous system. Narcotic poisons can also be subdivided into cerebral, spinal, and cerebro-spinal, according to whether the substance affects directly the brain, the spinal marrow, or both of these organs. Irritant poisons, when taken in small doses, speedily occasion violent vomiting and purging. These symptoms are either accompanied or followed by intense pain in the abdomen. As their name implies, their action is to irritate and inflame. Many substances belonging to this class of poisons possess corrosive properties—such as the strong mineral acids, caustic alkalies, bromine, corrosive sublimate, and others. Some irritants do not possess any corrosive action—such as arsenic, the poisonous salts of baryta, carbonate of lead, cantharides, &c., which are called pure irritants; they exert no destructive chemical action on the tissues, they simply irritate them. The sale of poisons in this country is regulated by several Acts of Parliament, the most recent being the Pharmacy Act of 1868. Formerly poisoning was, by the law of England, petty treason, and the punishment was boiling to death. The malicious poisoning of cattle, domestic animals, and game, is an offence punishable by fine or imprisonment.

Poison-Fang and Poison-Glands. (*See* SERPENT.)

POLAR CIRCLE. (*See* EARTH and PHYSICAL GEOGRAPHY.)

POLARIZATION OF LIGHT, *po-lar-i-zai'-shun.*—Light which has undergone certain reflections or refractions, or been subjected to the action of material bodies in any one of a great number of ways, acquires a certain modification. In consequence of this change, it no longer presents the same phenomena of reflection and transmission as ordinary light. This modification is called the *polarization of light*; its rays being supposed to have acquired *poles*, like the magnet, or sides with opposite properties. Polarization may be effected in various ways, but principally by the following :—1, by reflection at a proper angle from the surfaces of transparent media ; 2, by transmission through crystals possessing the property of double refraction ; 3, by transmission through a sufficient number of transparent uncrystallized plates placed at proper angles ; 4, by transmission through a number of other bodies imperfectly crystallized—as agate, mother-of-pearl, &c. When common light passes through a slice of tourmaline, as a crystal of herapathite, the light polarized in one place is absorbed, while that polarized in the opposite place is transmitted. (*See* LIGHT.)

Polarization of Heat.—Heat, like light, can be polarized. When a beam of radiant heat is passed through a rhomb of Iceland spar, it is split up into two equal beams, both of which are polarized, the first in the principal plane, the second in a plane at right angles to it. Heat may also be polarized by reflection, and, under certain conditions, by emission.

Polarization of the Sky.—The light from a clear sky is polarized, the maximum effect being 90° from the sun ; consequently, as the position of the sun varies from hour to hour, the plane of maximum polarization varies also. Upon this fact, Sir Charles Wheatstone based the idea of a polar clock, consisting of a tube pointed in the direction of the earth's axis, filled with a double-image prism at the lower end as an eye-piece, and a small hole covered by a thin plate of selenite at the end, which points to the north pole in the sky. The prism is capable of rotation, and points to the hours engraved on a semicircle. When the eye-piece is rotated until the position of "no colour" is gained, the index will point to the right time.

Polariscope.—An instrument for showing the phenomena of polarized light It consists essentially of a polarizer (for large objects a plate of blackened glass, and for small objects a prism, a tourmaline, or a crystal of herapathite) and an analyser, either a prism, a tourmaline, or of herapathite.

POLE, *pole* (Lat., *polus*, the end of an *axis*). —Literally, the word *pole* signifies that which turns, or on which something turns ; but in Physics, the term is applied to the extremities of the axis about which a body revolves, or is supposed to revolve : thus, the *poles of the earth* are the extremities of the imaginary axis round which the world is supposed to revolve. The zenith and the nadir are also looked upon as the poles of the horizon. In a *magnet*, the poles are two points corresponding to the poles of the earth, one pointing to the north and the other to the south. In a *voltaic pile*, or *battery*, the poles are the extremities of the two wires that connect the opposite ends of the pile or battery. The term *polarity* is used in Physics to denote that property of bodies which enables them, when allowed to move freely, to arrange themselves in certain determinate directions, or point, as it were, to given poles. Thus we speak of the polarity of the magnet or magnetic needle. In order to account for certain phenomena in optics, it is necessary to assume that the particles of light possess *polarity* : this simply signifies that the opposite sides of each particle possess different physical qualities.

POLECAT, OR FITCHET, *pole'-kat.*—A quadruped of the *Mustelidæ*, or Weasel tribe, a family of digitigrade carnivorous animals. The polecat, which is found throughout Europe, is stouter in proportion than either the common weasel or the ermine, and the head broader. Nose rather pointed, ears round and not conspicuous ; back comparatively short, tail, including the body, rather more than a third of the length of the body and head. The fur is sometimes fulvous and woolly, and sometimes long, black, and shining, and, although inferior to the fur of the sable or marten, is nevertheless esteemed. A considerable importation of the skins annually come to this country from the north of Europe under the name of *Fitch*. The length of the head and body is about seventeen inches, and that of the tail about six. It exhales a strong and disagreeable odour. The polecat is most destructive to the poultry-yard and the preserve, its appetite for slaughter seeming never to be satiated as long as any living thing remains within its reach, and its courage being, at the same time, very great. Its nest is generally made in some rabbit-burrow, in the crevice of a rock, or where the tangled herbage and brushwood overgrow loose heaps of stones ; and there the female drops from four to six young in May or early in June.

POLEMONIACEÆ, *pol-e-mo-ne-ai'-se-e* (Gr., *polemos*, war ; Pliny says the polemonium gained its name from having caused a war between two kings, each of whom claimed the honour of first discovering its virtues).—The Phlox family, a natural order of *Dicotyledones*, sub-class *Corolliflorœ*. There are 17 genera, comprising 104 species. They abound in the temperate parts of North and South America. Many species are cultivated in our gardens on account of the prettiness of their flowers. None have any claim to the extraordinary healing virtues of the unknown plant after which the typical genus has been named.

POLE-STAR, OR POLARIS.—A star in the constellation Ursa Minor, and to which the eye is directed by following the prolongation of an imaginary line between the two "pointers" of the constellation Ursa Major, or the Great Bear. It is the nearest conspicuous star to the north pole of the celestial equator, and marks very nearly the true north. It never sets in the northern hemisphere. Owing to the change in the relative positions of the celestial equator, and that of the ecliptic (*see* PRECESSION OF THE EQUINOXES), this particular star has not always held, and will not always retain, its apparent position. Two thousand years ago one of the pointers of the Great Bear was the north star, and two thousand years earlier a star in the constellation Draco was near the north pole.

POLIANTHES, *po-li-an'-thes.* (*See* TUBEROSE.)

POLLACK, *pol'-lak.*—A fish (*Merlangus pollachius*) of the family *Gadidæ*, of the same genus as the whiting, but larger. It is common on the British coasts, is very lively, and readily rises to an artificial fly made of a small white feather. The body is long, and there are three dorsal fins.

POLLAN, *pol'-lan.* — A fresh-water fish (*Coregonus pollan*) of the family *Salmonidæ*. (*See* COREGONUS.) It is particularly abundant in Lough Neagh, but is found in nearly all the Irish lakes. It averages about 10 inches in length, has a good flavour, and immense quantities are taken in the summer months and sold in Belfast.

POLLARDING, *pol'-lard-ing.*—Cutting off the top branches of a tree, leaving it to send out new branches from the top of the trunk. The cut branches are used for fuel in districts where coal is expensive, and the operation of pollarding is repeated about every fourth year. Willows, poplars, alders, elms, and lime are the trees most frequently pollarded in this country.

POLLEN, *pol'-len* (Lat.).—The fertilizing powder contained in the anther of plants. When mature, each pollen-grain is a cellular body, having two membranous coverings—an internal or *intine*, and an external or *extine*. Within these coverings a granular semi-fluid matter, called the *fovilla*, is contained. This matter is, without doubt, the essential part of the pollen-grain. At the period of fecundation, the pollen-grains are thrown upon the stigma, which has become moistened by a sticky juice.

POLYANTHUS, *pol-e-an'-thus* (Gr., many flowered).—A variety of the primrose, developed by cultivation on account of the number and beauty of the flowers produced. The seed should be sown about midsummer, and then the flowers may be looked for in the following year. It is a hardy plant, and fine kinds may be preserved by dividing the root.

POLYCOTYLEDONOUS PLANTS, *pol-e-ko-te-led'-on-us*.—Plants which have more than two seed-lobes or cotyledons, of which the Coniferæ afford many conspicuous examples.

POLYDIPSIA, *pol-e-dip'-se-a* (Gr., great thirst.) (*See* DIABETES.)

POLYGALA, *po-lig'-a-la* (Gr., *polus*, much; *gala*, milk).—The typical genus of the natural order *Polygalaceæ*. The species *P. vulgaris*, the common milkwort, is an inconspicuous but beautiful plant, with blue, pink, or white flowers, found in our dry pastures and peaty fens. This and many other species have bitter properties; they have been used medicinally as tonics, stimulants, diaphoretics &c. *P. Senega*, the Senega snake-root, is a most interesting species. Its root was first introduced into medicine as an antidote to the bites of snakes, but it is now considered useless in such cases. It is, however, a valuable drug, and is officinal in this country, being used either in large doses as an emetic and cathartic, or in small doses as an expectorant, diaphoretic, diuretic, and emmenagogue. Its principal virtues are due to the presence of a very acrid solid substance, which has been called *senegin*, *polygalin*, and *polygalic acid*. Many other species, American, European, and Asiatic, possess very similar properties, and one species, *P. venenosa*, a native of Java, has the acrid principle in so concentrated a state as to render the whole plant poisonous. An Arabian species, *P. tinctoria*, is used for dyeing.

POLYGALACEÆ, *po-lig-a-lai'-se-e*.—A natural order of *Dicotyledones*, sub-class *Thalamifloræ*. Some genera of this order are found in almost every part of the globe. The individual genera are, however, generally confined to particular regions, with the exception of the genus *Polygala*, which is very widely distributed, being found in almost every description of station, and in both warm and temperate regions. A few species have edible fruits, but the order generally is characterized by bitterness and acridity. There are 20 genera, and nearly 500 species. (*See* POLYGALA.)

POLYGAMOUS, *pol-ig'-am-us*.—In Botany, a term applied to those plants which produce both universal and hermaphrodite flowers.

POLYGONACEÆ, *pol-e-go-nai'-se-e*.—The Buckwheat family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*, and usually herbs. There are about 34 genera and 500 species, generally diffused over the globe, but particularly abundant in temperate regions. They are chiefly remarkable for the presence of acid, astringent, and purgative properties. Rhubarb, sorrel, buckwheat, and bistort-root are some of the useful products of this family. The typical genus is *P. Bistorta*, commonly called bistort-root, the seeds of which are a powerful astringent. The leaves of *P. Hydropiper* are very acrid; hence the common name of water-pepper, which is given to this plant. Blue and yellow dyes are obtained from different species.

POLYGONATUM, *po-lig-o-nai'-tum* (Gr., *polus*, many; *gonu*, joints; it has numerous knots).—A genus of the natural order *Liliaceæ*. The rhizomes of *P. officinale* are sold in the herb-shops under the name of *Solomon's seal*, and are employed as a popular application to remove the marks from bruised parts of the body.

POLYMORPHISM, *pol-e-mor'-fizm* (Gr., *polus*, many; *morphe*, a form).—In Crystallography, it has been observed that some substances crystallize in two incompatible forms—that is, in forms belonging to two different systems. Such forms have been called *dimorphous*, and the phenomenon itself *polymorphism*. It has been noticed that the forms of dimorphous crystals almost always occur near the boundary-lines, as it were, of the two systems. Polymorphism frequently enables the chemist to recognize an isomorphism that would otherwise be overlooked.

POLYPE, POLYPI, *pol'-eep*, *pol-e-pi* (Gr., *polupous*, having many feet).—A class of the invertebrate animals, and one of the largest and most remarkable in the animal kingdom. In this class are comprehended gelatinous animals, with elongated contractile bodies, and an alimentary sac with only one opening. They have distinct terminal mouths, surrounded with tentacula or radiated lobes. The greater part of these beings adhere together and form compound animals. They are all of the simplest kind, and possess so low an organization that they appear nearly incapable of reproducing their species. Without heads and without eyes, they have neither organs suited for circulation, respiration, nor locomotion. In appearance their bodies are only a homogeneous mass, consisting of a gelatinous and irritable cellular tissue, in which the vital fluids move slowly. In form, the body is generally cylindrical or conical, and of a transparent texture; and there is no opening but the mouth, which is surrounded by tentacula, varying in their number and size. Some very remarkable facts are related concerning these strange animals. It would appear that the principle of life is so universally diffused through their simple structure, that portions of them may be cut or broken off, and these portions, if allowed to remain in their native element, will soon become perfect animals, with all their functions fully developed. Sometimes the hydra will split in two of its own accord, and each division becomes an independent animal, growing to the same size as the original hydra. In the lowest race of polypi, the distinctive characters of animal life are so slightly developed, that there is great difficulty in distinguishing them from the cryptogamic families of the vegetable kingdom. From the egg of these polypi is formed a bulb, from which a stem, sending out branches, shoots up; there is also a root which only serves as an organ of attachment, and not for nourishment. They supply themselves with food by means of their long tentacula, which are the only members capable of voluntary motion. For a long time they were called *animal plants*. Nearly every kind of polypi is attached by the root of the stem or base to submarine rocks or other extraneous bodies. The reproduction of all the adhesive polypi depends on the formation of gemmules, or imperfectly formed portions of their soft substance. Each of these gemmules is endowed with active powers of locomotion, apparently for the sole purpose of selecting a place whereon to raise its future residence: the situation once being chosen, it is fixed to that spot during its life.

POLYPHEMUS, *pol-e-fe'-mus.*—A genus of *Branchiopoda*, of the order *Cladocera*, having only one eye, and that of very great size, for which the name (that of the one-eyed giant of Homer's "Odyssey") was taken. One species, *P. stagnorum*, about the size of a flea, is found in stagnant pools and ditches, moving about with great rapidity. The shell is so transparent the viscera can be seen through it.

POLYPODIUM, *pol-e-po'-de-um* (Gr., *polus*, many).—A genus of ferns, characterized by the sporangia being in circular clusters and naked, and by the edge of the frond being flat, not reflexed. There are about six species found in the United Kingdom, but most of them are rare plants, except in certain localities dear to the fern-collector. *P. vulgare*, the common polypody, found on shady banks, walls, and old trees, is a beautiful fern. The fronds are deeply pinnatifid; the lobes linear-oblong, somewhat serrate, all parallel, the upper ones becoming gradually smaller. The rhizomes of some species of this genus are used medicinally in Peru, and are said to possess sudorific, diuretic, febrifugal, and other useful properties.

POLYPORUS, *po-lip'-o-rus.*—A genus of *Fungi*. One species has been named *P. destructor* from the circumstance that the development of its spores in timber is one of the causes of dry rot. From various species, *Amadou* or German tinder, as noticed in another part of this Dictionary. *P. officinalis*, the larch, or white agaric, has been employed medicinally, externally as an astringent application, and internally to check perspiration; also as an emetic and cathartic. (*See* AMADOU.)

POLYPTERIDÆ, *pol-ip'-te-ri-de.*—A family of ganoid fishes. The head is defended by large bony plates, and the body covered by bony scales. They are about 18 inches long, abound in the mud of great African rivers, especially the Nile, and their flesh is considered excellent. The Egyptian fish is known as the Bichir.

POLYPUS, *pol'-e-pus.*—An old term in Surgery for a tumour, generally attached to the mucous membrane, the uterus, the nostrils, or the ears.

POLYZOA, *ol-e-zo'-a.*—Minute organization, known also as Bryozoa and Ciliobrachiata, many of the species of which encrust other animals like moss. Some naturalists class them with the polypes, but the majority regard them as molluscoid animals. Immense numbers of them collect together, forming masses divided into cells, each inhabited by an individual organization.

POMACEÆ, OR POMEÆ, *pom-a'-se-a, pom'-e-a.*—A sub-order of the natural order *Rosaceæ*, including the apple, pear, quince, hawthorn, and many other well-known plants. They are all trees or shrubs, abounding in the temperate regions of the northern hemisphere.

POMADE, *po-made'*. (*See* POMATUM.)

POMEGRANATE. (*See* PUNICA.)

POMERANIAN DOG, *po-me-rai'-ne-an.*—The characteristics of this dog, which is well known in England, are a pointed nose, erect ears, and a bushy tail curled over the back. Its fur, which is usually long and soft, is white, white and brown, or buff. These dogs are commonly used by the Dutch and inland navigators to protect property on board vessels, and they are frequently found as watch-dogs on German farms.

POMOLOGY, *pom-ol'-o-je.*—A name sometimes given to the study of fruits and the modes of cultivation, particularly the apple, the pear, and similar fruits.

POMPELMOOSE, *Pom-pel-moose'.*—A fruit (*Citrus pompelmoos*), greatly resembling the Shaddoch. It is of large size and of a pale yellow colour, and in flower resembles a fine orange. Preserved with wine and sugar, it is very agreeable in hot climates, especially in the East Indies, where it is carefully cultivated.

PONDWEED, *pond'-weed.*—A genus of plants (*Potamogeton*) of the natural order *Naiades*. There are various species found in lakes, rivers, and ditches, throughout Europe generally, and some are met with in Australia. In some species the leaves are submerged, in others there are floating leaves of a different form. The seeds and roots are favourite food for aquatic birds.

PONGO, *pon'-go.*—An ape (*Pithecus Wormbii*) allied to the Ourang, but much larger in size, in some instances attaining a height of six feet. (*See* OURANG-OUTANG.)

PONTEDERACEÆ, *pon-te-de-rai'-se-e.* A natural order of *Monocotyledones*, sub-class *Petaloideæ*, consisting of aquatic plants, natives of the East Indies, Africa, and America. They are unimportant.

PONY, *po'-ne.*—A name applied to very small active horses, chiefly bred in hilly or sterile regions. They are very hardy, and for their small size very strong, generally living in a semi-wild condition, although, in this country, private property. Not being so well trained, they are tricky and more liable to be vicious than horses are. Their coats are generally very rough, and they have large shaggy manes and forelocks. The smallest of the British breeds are the Shetland ponies; other well known breeds are the Galloway, Welsh, Dartmoor, Exmoor, and New Forest, ponies. There are many breeds in various parts of Europe, some known to have existed from very remote times.

POODLE, *pood'-l.*—A breed of small dogs, much in favour as pets. The poodle has a projecting short muzzle, small pendant ears, and a short tail, and is covered with long curled white hair, which, in some of the more cultivated varieties, reaches to the ground. It is the fashion, however, to cut the hair short on the hinder part of the body and legs, leaving tufts round the feet, giving to the little pet a peculiar and almost grotesque appearance. No dog is more intelligent or affectionate, and poodles make the best performing dogs.

POONA-WOOD, *poo'-na.*—The timber of the Poona tree (*Calophyllum inophyllum* and *C. augustifolium*), are natives of Penang and the countries eastward of the Bay of Bengal. It is valuable for ship-building purposes.

POPLAR, *pop'-lar.*—A genus of trees (*populus*) of the natural order *Salicaceæ*. All the species are rapid-growing, soft-wooded timber trees, some of which attain a great size. *Populus alba*, the White Poplar, is perhaps the most valuable of the British species. It is a highly ornamental tree, and furnishes a soft, white, stringy timber, which is employed to make all sorts of wooden vessels and utensils; being especially valued for butchers' trays and turners' ware. The Gray Poplar (*P. canescens*) is a large spreading tree, with harder and better timber. The Black Poplar (*P. nigra*) is a tall tree, with a spreading head. The well-known and ornamental Lombardy Poplar attains a great height, in many cases over 100 feet, and has an erect form, and contracted head. There are various American species of the tree. Several species have tonic, astringent, and febrifugal bark, containing the active principle *salicine*.

POPPY, *pop'-pe.* (*See* PAPAVERACEÆ.)

PORBEAGLE, *por'-be-gl.*—A fish of the shark family (*Lamna Cornubica*), occasionally met with on the British coasts. It is about six feet long, and very voracious, has two dorsal fins, and a large and forked tail. It is commonly known as the Beaumaris shark.

PORK (Fr., *porc*, a hog).—The flesh of swine. In some respects it is less nutritious than other animal food; but it has especial qualities which recommend it. The quantity of fat makes it heat-giving, and therefore suitable for cold and temperate climates, while it surpasses all other kinds of animal food in the ease with which it may be preserved by salting and drying. Young and well-fed pork is delicious in flavour. The trade in preserved or "pickled" pork is very large, and in Cincinnati and other large towns of the United States, is carried on to an immense extent. In Ireland, especially in the neighbourhood of Cork, the pork trade is of great importance.

POROSITY, *po-ros'-e-te* (Gr., *poros*, a passage). — That condition of material bodies in which the molecules are not in absolute contact, but separated by intervals called *pores*. It is an essential property of all bodies—that is, there are none known in which the particles are contiguous to one another. In some bodies the pores are not manifest, and their existence is proved by various circumstances. Many of the metals become more compact by hammering, and all of them contract by reduction of temperature. In trying to compress water in a sphere of gold, the Florentine philosophers forced the liquid through the pores of the metal. The porosity of many substances is inferred from their elasticity and the sounds which are heard when the molecules are made to vibrate. In transparent bodies, porosity is inferred from the capability of the substance to transmit light. The porosity of the human skin is of such a character that it has been calculated that there are a thousand holes, or pores, in the length of an inch. The whole surface of the body of a middle-sized man being estimated at sixteen square feet, it must contain no fewer than 2,304,000 pores. The permeability of all solid bodies by any fluid depends upon its peculiar structure and upon its relation to the fluid. A compact substance will sometimes oppose the entrance of a thin fluid, while a gross one passes freely through it; thus, a cask which holds water will allow oil to ooze through it, while mercury may be carried in a small cambric bag which could not retain water for a moment.

PORPHYRA, *por'-fi-ra* (Gr., *porphura*, purple).—A genus of *Algæ*, or sea-weeds. *P. lacinaria* and *vulgaris* are employed as food in the form of a sauce or pickle, which has received in different parts of Britain the names *sloke*, *slokan*, and *laver*. Though this preparation has a very repulsive appearance, it is remarkably wholesome and savoury. *P. vulgaris* is commonly eaten in China as a relish to rice, being known as *Tsz-Tsai*, or the purple vegetable.

PORPHYRY.—A term employed by geologists to any rock which has a homogeneous earthy base, through which are scattered crystals of one or more minerals of contemporary origin. Anciently, the name was limited to an Egyptian rock used in sculpture, now known as *Rosso antico*.

PORPOISE, *por'-pus* (Ital., *porco pesce*).—A genus (*Phocæna*) of Cetacea, of the family *Delphinidæ*. It is the most common of all the cetacea on the British coasts. The porpoise swim in shoals, and drive the herring, mackerel, and salmon before them, pursuing them up the bays with the same eagerness as a dog does a hare. In some places they almost darken the sea as they rise above water to take breath. They not only seek for prey near the surface, but often descend to the bottom in search of sand-eels and sea-worms, which they root out of the sand with their noses. They go up rivers in pursuit of salmon and other fish, and have been seen at a considerable distance inland. In fine weather they leap, roll, and tumble, and appear heedless and blind to all danger. The oil procured from the fat surrounding the body of the porpoise is of the purest kind, and the skin, when carefully tanned and dressed, is used for wearing-apparel and for coverings of carriages. As an article of food, its flesh was anciently esteemed, and in Henry VIII.'s time was even a royal dish, appearing to have been generally presented as a roast, with a sauce made of fine white bread-crumbs mixed with vinegar and sugar. At a later period, the porpoise kept its ground on the tables of Roman Catholics on fish days and during Lent. Its length is from five to eight feet.

PORT-FIRE, *port'-fire.*—A slow match for firing guns, consisting of a paper tube filled with a composition of saltpetre, sulphur, and gunpowder, tightly rammed into the tube. It burns for a long period. Other forms of port-fire are brown paper dipped in a solution of nitre, dried and rolled up, also of the wood of lime, birch, or poplar, boiled for several hours in a solution of nitrate of lead, and afterwards in spirits of turpentine.

PORTLAND BEDS.—In Geology, a division of the Upper Oolites, so named because arches of the group form the promontory known as the Isle of Portland, in Dorsetshire. The fossils are mostly mollusca and fish, with a few reptiles; and there are corals converted into flints, the original structure being remarkably preserved.

PORTLAND STONE.—A valuable building stone obtained from quarries in the Portland and Purbeck beds is the oolitic limestone of Dorsetshire. Immense quantities of the stone are quarried. St. Paul's Cathedral, London, and many other churches erected by Sir Christopher Wren, are built of Portland stone, and the great Portland breakwater is entirely composed of it. The principal ingredient in the composition of the stone is carbonate of lime; but there are minute amounts of silica, carbonate of magnesia, iron, and alumina.

PORTULACACEÆ, *por-tu-la-kai'-se-e* (Lat., *portula*, a little gate—its leaves resemble little doors).—The Purslane family, a natural order of *Dicotyledones*, sub-class *Calyciflorœ*. They are succulent herbs or shrubs, found in waste dry places in various parts of the world, but especially at the Cape of Good Hope and in South America. There are 12 genera, which comprise 184 species. *Portulaca oleracea*, purslane, has been used from the earliest times as a pot-herb and in salads. It has cooling and antiscorbutic properties. The fleshy root of *Claytonia tuberosa*, another plant of this order, is edible. Many *Portulacaceœ* have large showy flowers.

POSSET, *pos'-set.*—A drink, useful as a remedy for colds and coughs, made by curdling milk, with wine or ale, but most commonly with the former. A little vinegar or lemon-juice is sometimes added, as also treacle for sweetening.

POTASH, POTASSA, *pot'-ash, po-tas'-sa.* —Anhydrous potassa can only be obtained by heating the hydrate with an equivalent weight of potassium in an atmosphere free from oxygen. It is a hard gray solid, fusible at a red heat, and convertible into vapour at a high temperature. When thrown into water, it seizes an equivalent of that substance with such violence as to become red-hot during the process. The symbol is K, the initial of Kali, the Arabic name. The hydrate, ordinary caustic potash, KO.HO, is a compound of very great importance. It is generally prepared by dissolving one part of the carbonate in ten of water, and adding from time to time to the heated solution small quantities of milk of lime until the clear liquid ceases to effervesce on the addition of an acid. The mixture is boiled for a quarter of an hour, after which it is allowed to stand until all the solid particles have settled. The clear liquid is then drawn off by decantation and evaporated to a syrupy consistence, after which it is poured on a clean iron plate and allowed to solidify. Hydrate of potash, when perfectly pure, is a hard white solid, generally met with in commerce in the form of cast sticks. It fuses at a red heat, and rises in vapour if the temperature be raised. The water it contains cannot be separated by heat alone. Thrown into water, it dissolves with disengagement of heat, accompanied by a hissing sound. Exposed to the air, it deliquesces into a syrupy liquid, which gradually absorbs carbonic acid. It is the most powerful alkali known. It forms well-defined salts with all the acids, all of which are soluble in water. Its uses in the laboratory and manufactory are manifold, both in the solid and liquid conditions. The solid hydrate, from having a great affinity for water, is used by the chemist for drying gases, for decomposing silicious compounds, and various organic substances. It is used in surgery as a caustic, and in manufactures for the production of soft soap. Its solution is used in medicine as an antacid, and in analysis as an absorbent of carbonic acid. The solution should be preserved in green glass bottles, glass containing lead being dissolved by it. It should be kept from contact with the air, as it greedily absorbs carbonic acid, passing into the form of carbonate.

Bitartrate of Potash.—This substance exists in considerable quantities in the juice of the grape, and is left as a deposit in wine-casks, forming a crystalline encrustation called *argal*, or *crude tartar*. It is purified by solution and crystallization, which renders it perfectly white. When in fine powder, it is called *cream of tartar*.

Carbonates of Potash.—There are two carbonates of potash,—the ordinary carbonate and the bicarbonate. Carbonate of potash exists in the ashes of inland plants, from which it is extracted by lixiviation. The lye thus obtained is evaporated to dryness, and calcined till all the volatile organic matter is burnt off. The mass left is known in commerce as *crude potash*; and contains about 60 per cent. of alkaline carbonate. Crude potash is partially purified by solution in a small quantity of water, filtering and evaporating, the sulphate of potash being allowed to crystallize out. Further evaporation produces a crystalline impure carbonate of potash, known commercially as *pearlash*. Still further purified, it forms *salt of tartar*. It is employed largely in the manufacture of soap and glass. It is also used as a detergent, and as the source of most salts of potash. In rectifying spirits of wine, it is employed in a fused state to abstract the water. The *bicarbonate* is prepared by passing carbonic acid through a saturated solution of the mono-carbonate, when, being less soluble, it is precipitated. It is occasionally used in medicine. The carbonates of potash are both alkaline to test-paper.

Chlorate of Potash.—There are various ways of forming this salt, the best of which is by passing chlorine through a mixture of solution of caustic potash and hydrate of lime. If the proportions be properly observed, the whole of the potash is converted into chlorate, and the lime into chloride of calcium—the former salt being easily separated by crystallization. It possesses powerful oxidizing properties, and is thence used in the manufacture of lucifer-matches, for certain detonating powders in pyrotechny, and in calico-printing. It is occasionally used in medicine as a sudorific and diuretic.

Nitrate of Potash, known also as nitre or saltpetre, occurs as an encrustation on the surface of the earth in hot climates, more especially in India, Arabia, and South America. In more temperate countries, especially in those not favourably situated for the importation of this salt, it is obtained by artificial processes. Refuse animal matters, mixed with lime rubbish, are exposed to the air in heaps, and watered from time to time with stale urine and stable-runnings. At certain intervals, the impure salt is extracted from the top layer of the heap by lixiviation. Besides the natural and artificial sources of nitre above mentioned, it also occurs in the juices of certain plants. The theory of natural nitrification is but little understood, although it has been the subject of much investigation and discussion amongst chemists. The principal use of nitre is in the manufacture of gunpowder. For this purpose, it is necessary that the smallest portions of other salts, with which it is liable to be contaminated, should be removed. The fused salt is known in pharmacy as *sal prunelle*. Nitre is a dimorphous salt, crystallizing in colourless hexagonal prisms with dihedral summits, and in flattened rhombohedra, both of which are anhydrous. Nitrate of potash has a cool saline taste; it dissolves in five parts of cold water with considerable depression of temperature, and in less than its own weight of boiling water. It is but very slightly soluble in alcohol. At high temperatures, it acts as a very powerful oxidizing agent, and is greatly used for this purpose, both in the manufacture and the laboratory. Even silver, gold, and platinum become oxidized under its influence.

Prussiate of Potash.—A term applied in ordinary language to the ferrocyanide of potassium. It is prepared by gently igniting carbonate of potash with animal matter, such as horns, hoofs, or dried blood, in iron vessels, by which means cyanide of potassium and some cyanide of iron are formed. The soluble parts, then washed out with water and sulphate of iron added until the Prussian blue which is formed ceases to be decomposed by the free potash contained in the solution. The ferrocyanide of potassium is then set to crystallize and separate from sulphate of potash by repeated crystallization. Prussiate of potash is much used in chemistry as a test for the presence of metals, especially of iron, peroxide of which is precipitated from its solutions in the form of Prussian blue.

Sulphates of Potash.—There are two sulphates of potash—the ordinary sulphate and the acid bisulphate.

POTASSIUM, *po-tas'-se-um.*—This remarkable metal, which is the base of the alkali potash, was discovered in 1807, by Sir Humphrey Davy, and its isolation marks an important era in the progress of philosophical chemistry. Up to this time the alkalies and earths had long been suspected to be compound bodies, but had resisted every endeavour to decompose them. Sir Humphrey Davy, however, having succeeded in decomposing potash by the voltaic current, the decomposition of the other alkaline bodies followed, as a matter of course. Not only this, but potassium itself, from its powerful affinity for oxygen, formed a valuable decomposing agent. Potassium is a silver-white metal, with a slight bluish tint; at 32° Fahr. it is brittle, and has a crystalline fracture; at temperature above freezing-point, it gradually becomes malleable, until it reaches 60°, when it is pasty. Exposed to the air, it becomes covered with a film of oxide almost immediately, and when thrown into water, its affinity for oxygen is so great, that sufficient heat is produced to volatilize and fire the metal, which burns with a beautiful rose-coloured flame, until the whole is oxidized. Potassium decomposes nearly all gases which contain oxygen, if heated in contact with them; and at a high temperature it will remove oxygen from all bodies containing it. Hence its use in preparing the metals of the alkaline earths.

Bromide of Potassium.—This salt is prepared by adding bromine to a solution of caustic potash until it assumes a slight yellow tinge. Bromide of potassium and bromate of potash are formed, and the latter salt is decomposed by a current of sulphuretted hydrogen. It crystallizes in cubes and is very soluble. It is used in photography and pharmacy.

Chloride of Potassium.—This salt is largely extracted from kelp, and is used principally as a source of potash in the manufacture of potash alum.

Iodide of Potassium.—This important salt is much used in photography as an iodizing agent, and in medicine as an alterative.

Sulphides of Potassium.—Potassium combines with sulphur in at least five different proportions. The protosulphide is formed when hydrogen is passed over sulphate of potash at a red heat, or by heating to bright redness three parts of sulphate of potash and one of finely-divided charcoal intimately mixed. Protosulphide of potassium, when heated in the air, absorbs oxygen, and becomes coated with a film of sulphate of potash. Exposed to the air, at ordinary temperatures, it deliquesces. It dissolves readily in water, forming a colourless caustic solution. Saturated with hydrosulphuric acid, its solution yields a peculiar compound of sulphide of potassium and hydrosulphuric acid, or the hydrosulphate of the sulphide of potassium. The higher sulphides of potassium may be obtained by fusing the sulphide with the proper proportions of sulphur. *Hepar sulphuris*, or liver of sulphur, was formerly used in medicine, and is now employed as a source of milk of sulphur. It is prepared by fusing equal weights of carbonate of potash and sulphur at a temperature of 500° Fahr. This resulting compound contains protosulphide of potassium and hyposulphite of potash, from which milk of sulphur is precipitated on the addition of an acid.

POTATO, *po-tai'-to.*—A valuable esculent root, the tuber of *Solanum tuberosum.* (*See* SOLANUM.) It is one the most familiar of vegetables, and largely used as food in temperate climates. The potato-plant is supposed to be a native of South America. It appears probable that it was first brought into Spain from the mountainous parts of South America, in the neighbourhood of Quito, early in the 16th century. From Spain, where the tubers were called *battatas*, it found its way to Italy, and thence to Vienna. The potato was first brought to England from Virginia, by the colonists of Sir Walter Raleigh's expedition, who returned in 1586. Starch is largely obtained from potatoes, and is used for food under the names of English arrowroot, nutritious farina, &c. It is also employed in the preparation of dextrine, or starch-gum, which is much used in the arts. A decoction of the stem and leaves of the potato-plant has been used as an alterative in cutaneous diseases, and an extract of the herb has been also employed as a narcotic and antispasmodic. The medicinal properties of the plant are chiefly due to the presence of an alkaloid, called *solanine*, which has powerful narcotic properties. This has been detected in all parts of the plant; but in the tuber only traces of it are found, and these are entirely removed by the process of boiling and preparing potatoes for the table. There are innumerable varieties of potatoes, produced by careful cultivation. New varieties are produced from seed; but potatoes are ordinarily propagated by planting the tubers or cuttings of the tubers, each containing an eye, or bud. Potatoes are subject to many diseases, and are especially exposed to the ravages of the potato fly (*Authonyia tuberosa*), a dipterous insect similar to the flies which devastate other vegetable crops, and also to the destructive presence of the Colorado Beetle (which *see*). Great outbreaks of potato disease caused terrible famines in Ireland in 1846 and 1847, and had previously shown itself with disastrous consequences in Germany, Canada and the British Islands.

POTENTILLA, *po-ten-til'-la* (Lat., *potens*, powerful).—A genus of the natural order *Rosaceæ*. The rhizome and root of the species *P. Tormentilla* possess astringent and tonic properties. They are employed for tanning leather in the Orkney and Feroe Islands, and for the preparation of a red dye in Lapland.

POT-METAL.—An alloy of lead and copper, obtained by throwing lumps of copper into red-hot melted lead. It is of a gray colour, brittle, and granular.

POTOROO, *pot'-o-roo.* (*See* KANGAROO RAT.)

POT-POURRI, *pot-poo-re'* (Fr., a medley).—A mixture of sweet-scented flowers and aromatic substances, placed in a vase with a perforated lid. The name is also given in cookery to a dish of various kinds of viands.

In Music.—A selection of favourite pieces strung together without any precise arrangement.

POTSTONE, *pot'-stone.*—A mineral formed by a mixture of talc with chlorite and other matters. It is of a greenish colour, soft, and easily cut when newly quarried, but hard after exposure to the air. It has been used for the making of culinary vessels from very ancient times, was formerly procured in Upper Egypt, and is now quarried in the northern parts of Europe and America. It is the *Lapis Ollaris* of the ancient Romans.

POUCHED RAT.—A genus (*Pseudostoma*) of *Muridæ*. There are several species, natives of western North America. The name is taken from the cheek-pouches which are a peculiarity of the animal. They burrow in the ground and are very destructive to root-crops, and commit ravages, too, in fields and gardens.

POULPE, POOLP.—The Octopus, a genus of *Cephalopoda*, of the order *Dibranchiata*. It has eight arms of nearly equal length united at the base of a membrane, and of great length in proportion to the body; these arms are used for swimming, crawling on land, and seizing prey. When alarmed, or annoyed, they discharge an ink-coloured fluid. One species (*O. vulgaris*) is the Polypus of the ancients, and is common on the shores of the Mediterranean and occasionally found on the British shores. The arms are six times as long as the body, and each is furnished with 120 pair of suckers. In some cases the arms are two feet long, and there is reason to suppose that much larger species exists. Extraordinary stories are told of the size and ferocity of some of these creatures.

POULTICE. (*See* CATAPLASM).

POULTRY, *pole'-tre* (from Fr., *poule*, a hen).—A general term, which includes every kind of domestic fowl that is reared about the house or farmyard; as cocks and hens, ducks, geese, turkeys, &c. Although poultry constitutes part of the stock of every farmer in this country, the rearing of it is not often productive of any pecuniary advantage. Notwithstanding the fact that fowls are looked upon chiefly as articles of luxury, and sell at high prices in the market, they seldom or never repay the value of the corn which they have consumed, especially if such grain has to be purchased. There are many different breeds of fowls. Those best known are the game breed, the white or English breed, the black or Polish breed, the Dorkin breed, the large or shakebag breed, the Malay and the Cochin-China breeds. The two first are much smaller breeds than the others. This kind of stock affords profit in the eggs as well as the chickens; therefore, such as are the best layers and sitters should be chosen, which are in general the game and Polish breeds. The game and white breeds are considered the most delicate as food.

POUNCE.—Powdered resinous gum, resin, mastic, or copal, and also the powder of cuttle-fish bones. Before the use of blotting-paper became general, it was sprinkled over freshly-written paper to prevent blotting.

POWAN, *pow'-an*.—A fish (*Coregonus Cepedei*), frequently described as the freshwater herring, and found only in Loch Lomond, Scotland, where large shoals of them are seen in the morning and evening. It is caught by nets, and is considered a delicacy for the table. The usual length is about twelve inches, but fish of larger size are not uncommon.

PRACTICE, *prak'-tis*.—A rule of arithmetic, by which the operation of compound multiplication is simplified and shortened. It is employed chiefly for ascertaining the value of a number of articles, or weights with practical parts, at a certain price. The principle of the rule may be most easily illustrated by an example. Suppose we wish to find the value of 2715 articles at £1 7s. 6d. each, it is evident that, if the price were £1 each, the number of pounds value would be exactly equal to the number of articles. But the 7s. 6d. remains to be dealt with, and then we have to calculate the value of that portion of a pound and add it to the other, and here we have recourse to "aliquot parts." (*See* ALIQUOT.) Seven and sixpence is not an aliquot part of a pound, but 5s. is, and the 2s. 6d. required to make up the 7s. 6d. is half of 5s., or the eighth of £1, as we choose to consider it. The solution is then arrived at by adding to £2715, one quarter of that amount (representing 5s.), and one-eighth (representing 2s. 6d., and obtained either by dividing the number of pounds by eight, or the previous amount by 2) and adding the sums together, the total being the required answer:—

2715 at £1	£2715	0	0
2715 at 5s. (one-fourth)	678	15	0
2715 at 2s. 6d. (one-half the preceding)	339	7	6
	£3733	2	6

This easy example is sufficient to illustrate the principle of the rule, which can be applied to a great variety of cases. The working of the rule is of course much longer, but the principle is the same, when we have to solve such a question as this, "Find the value of 24 tons, 7 cwt., 3 qrs., 8 lbs., 4 oz., at £32 17s. 11¾d. per ton." In this case we first ascertain the value of the tons, then, by calculating the aliquot parts of the hundred-weights, and so on with the quarters, pounds, and ounces, the total obtained by addition of these sums being the answer required.

PRAIRIE, *prai'-ir-e* (Fr., a meadow).—A term used in North America to designate the vast natural meadows or plains which are found principally in the valley of the Mississippi. These prairies or savannahs, as they are also called, are generally described as:—1. *Heathy* or *bushy* prairies, which have springs, and are covered with small shrubs, bushes, grape-vines, &c.; very common in Indiana, Illinois, and Missouri. 2. *Dry* or *rolling prairies*, which are generally destitute of water and almost all vegetation, except grass. They are the most common and extensive. The traveller may wander for days in these vast and nearly level plains without food or water, and see no object rise above the horizon. 3. The *alluvial* or *wet* prairies, which form the third and smallest division. They are covered with a rich vegetation of tall rank grass. The soil is deep, black, friable, and fertile, and abounding with pools left by the floodings of the rainy season.

PRAIRIE-DOG.—A small rodent animal (*Arctomys Ludovicianus*), allied to the marmot, and found on the prairies west of the Mississippi. It is about fourteen inches in length, the tail being about three inches. The colour of the upper parts of the body is a light, dirty reddish-brown, mingled with gray, and with a few black hairs above, the under parts being a dirty white, the whiskers moderately long and black. It has been named *Prairie-dog* by the Anglo-Americans, from the supposed resemblance of its warning cry to that of a small dog; but the resemblance is by no means close. It is also known as the

Barking Squirrel. They live in burrows, many of which are congregated together in one district, and which sometimes cover an area of many miles. These burrows are sometimes level, or nearly so, with the ground; but more commonly form little mounds in the form of truncated cones, about a foot or a foot and a half in height, with a base of two or three feet, and about 20 feet apart. The entrance is either at the top or at one side, whence the hole descends vertically for a foot or two, and then runs obliquely downwards. Within this hole, which sometimes contains as many as seven or eight tenants, they form a globular cell of fine dry grass, in which they remain asleep during the winter, having carefully closed up the entrance, in order to resist the severity of the cold. In fine weather, they delight to play about the entrances to their burrows, into which they instantly drop on the appearance of any immediate danger; but if it be not too imminent, they remain at the edge, sitting erect, or flourishing their tails and barking, whilst on the look-out.

PRAIRIE-HEN. (*See* GROUSE.)

PRASE.—A rather rare green variety of quartz, generally found in masses, with prismatic or granular connections.

PRATIQUE, *prat'-eek.*—A limited quarantine. A ship is said to have performed pratique when the captain is able to show that there is no contagious disease on board.

PRAWN, *prawn.*—A genus of crustaceous (*Palæmon*) of the order *Decapoda* and sub-order *Macroura*. The common prawn (*P. serratus*) has large and round eyes; and the external antennæ is very long, being half as long again as the animal, from the tail to the extremity of the rostrum. The ordinary length is between three and four inches; the colour bright grey, spotted, and lined with darker purplish-grey. It is well known as a favourite article of food, and is found in vast numbers on all the coasts of Great Britain. In the adult condition they frequent rocky parts of the coast, delighting in still transparent water, where they disport amongst the long fuci which wave in the tide. They are sometimes taken in bag-nets, suspended from a circular ring of iron at the end of a pole; but in many parts the finest are caught in pots, resembling lobster-pots, but smaller, and made of a closer fabric.

PRECESSION OF THE EQUINOXES, *pre-ses'-shun* (Lat., *præ*, and *cedo*, I go).—A slow, retrograde motion of the equinoctial points from east to west, or contrary to the order of the signs. The pole, the solstices, the equinoxes, and all the other points of the ecliptic, have a retrograde motion, and are constantly moving from east to west, or from Aries towards Pisces, &c., by means of which the equinoctial points are carried farther and farther back at the rate of about 50¼″ each year; consequently, as the stars are immovable, and the equinoxes go backward, the stars appear to have an eastward motion with respect to them; for this reason, the longitudes of all the stars, which are reckoned from the first point of Aries, or the vernal equinox, are constantly increasing. It is in consequence of this *precession of the equinoxes* that the constellations seem to have changed the positions assigned to them by the ancient astronomers. This apparent motion of the stars was first observed by Hipparchus of Rhodes, about 128 B.C. He noticed that the longitudes of the stars were greater than had been observed by Timocharis, and than they were in the sphere of Eudoxus, who wrote 380 years before Christ. The gradual change in the longitude of the stars was also observed by Ptolemy; but he understated the quantity, making it only one degree in a hundred years, which is only equal to 36″ per year. The quantity of this change was calculated by Y-hang, a Chinese astronomer, in the year 721, to be one degree in eighty-three years, which is at the rate of 43½″ per year. The precessions have been made even more than this by some modern astronomers; but it is more usually taken as we have given it above, at 50¼″ per year. The true explanation of the cause of precession is one of the most difficult problems in physical astronomy. Even Sir Isaac Newton was unsuccessful in solving the problem in a perfectly satisfactory manner; more modern astronomers, however, such as D'Alembert, Euler, Laplace, and Simpson, have succeeded in it. According to their theory, the phenomenon is owing to the spheroidal figure of the earth, which itself arises from the rotation of the earth. Since more matter has thus been accumulated round the equatorial parts than anywhere else on the earth, the sun and moon, when on either side of the equator, by attracting this surplus matter at every return, bring the equator sooner under them than if no such accumulation of matter existed.

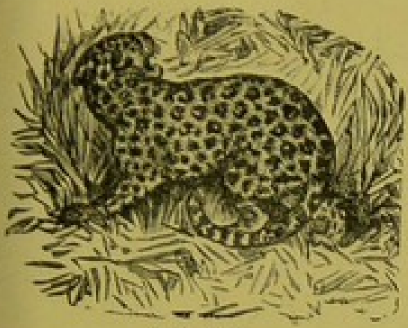
PRECIPITATE, *pre-sip'-e-tait* (Lat., *præceps*, headlong).—In Chemistry, any substance which, having been dissolved in a fluid, is *thrown down* in a solid form, on the addition of some other substance capable of decomposing the compound. Precipitates are generally in a finely-divided or flocculent state.

PRECOCITY, *pre-ko'-se-te.*—The unusually early development of remarkable power of mind or body, more generally applied to the former. It has been remarked that infant phenomena rarely retain their peculiar powers as they grow older, but there have been some notable exceptions to this rule; and it is probable that the practice of exhibiting, and so over-stimulating their extraordinary powers, has weakened their bodily constitution and injured their mental faculties. Careful discipline and restraint, and attention to bodily development, are the best methods of preserving their remarkable mental gifts.

PREGNANCY, *preg'-nan-se* (Lat., *prægnans*, with child).—The condition of a female about to give birth to young. The law makes concealment of pregnancy a criminal offence, as it is supposed to indicate an intention to conceal the birth, or make away with the child.

PREHNITE, *prai'-neet.*—A mineral composed chiefly of silica, alumina, and lime, the first forming about half of the whole. It is generally colourless, but sometimes has a greenish hue.

PRESCRIPTION.—In Medicine, a term applied to the written recipe or directions for compounding a medicine, suitable for a special case, given by a physician. In England it is customary for these prescriptions to be written in Latin, and symbols used for weights and measures. They begin with the symbol ℞, which means *Recipe*, take.



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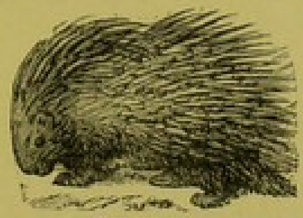

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VULPINE PHALANGIST.

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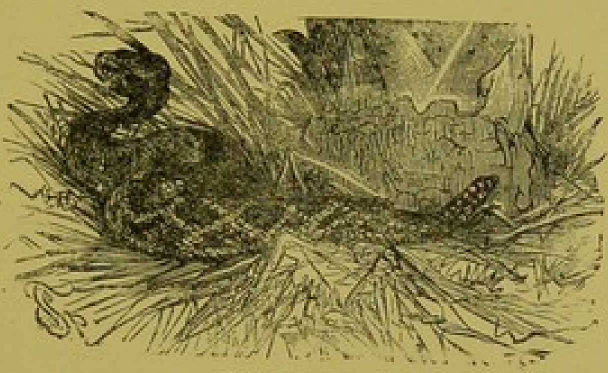

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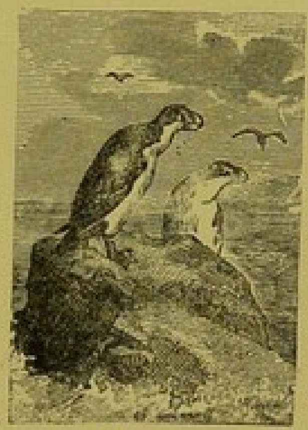

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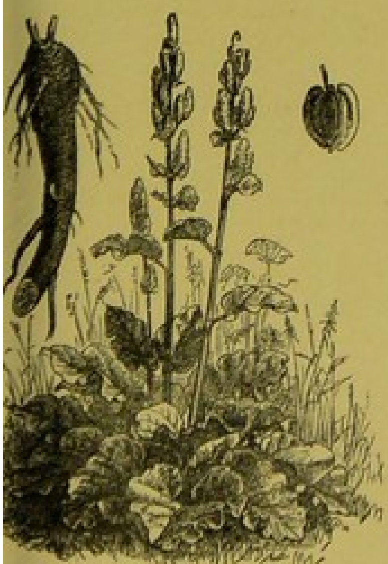

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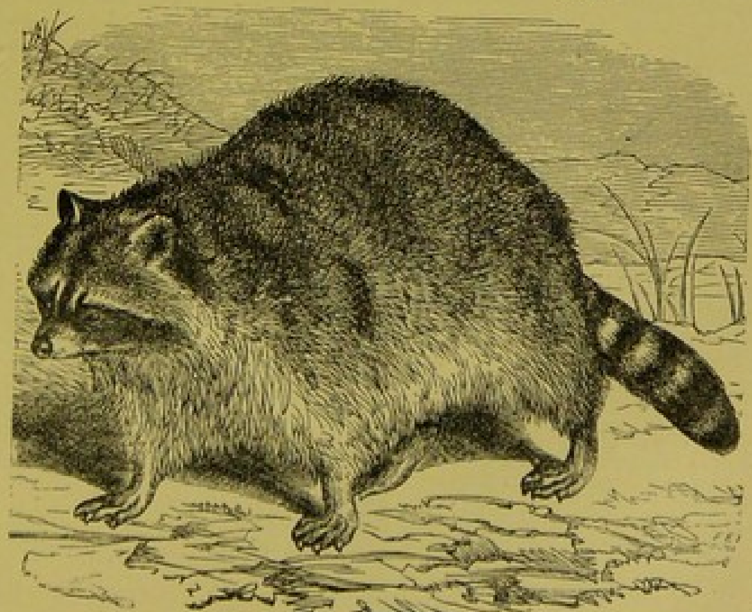


RACOON.

PRESSIROSTRES, *pres-si-ros'-treez.*—A tribe of birds belonging to the order *Grallatores*, but having the bill of moderate size, and the hind toe either wanting or very short. Bustards, lapwings, plovers, &c., belong to this tribe.

PRICKLES, *prik'-ls* (Sax., *priccian*, to prick).—A term used in Botany to designate those sharp prominences arising from the body or epidermis of any part of a plant, and thereby distinguished from the thorn, which grows from the wood of a plant. They originate in the cellular system, have no connection with the wood, and may be peeled off with the bark. The scientific term of the prickle is *aculeus*, from Lat. *acus*, a needle.

PRICKLY ASH. (*See* XANTHOXYLUM.)

PRICKLY HEAT.—A common name given in India and other hot countries to a severe skin eruption disease more scientifically known as *Lichen*. Zinc ointment is the best remedy.

PRICKLY PEAR. (*See* OPUNTIA.)

PRIDE OF INDIA, also called *Pride of China*, and *Bead Tree*.—An Oriental tree (*melia azedarach*), now naturalized in the warmer parts of America. It grows from 20 to 30 feet high, and often has a trunk 3 feet in diameter. It has bi-pinnate leaves, and its flowers are in large axillary bunches, with a small calyx. The fruit is an ovoid fleshy berry, about the size of a cherry, containing an elongated five-celled, five-seeded nut. The bark of the root has long been used as a vermifuge.

PRIMARY, OR PRIMITIVE LIMESTONE.—Formerly this name was given to the crystalline limestones because it was supposed that they belonged to the oldest or the primary deposits. But it is now known that many of them belong to much later periods. (*See* GEOLOGY, MARBLE, &c.)

PRIMATÉS, *pri-ma'-teez.*—A name given to the first order of Mammalia by Linnæus. The chief characteristics of this order are: incisors in front of mouth, four in the upper jaw; and two mammæ on the breast. Four genera are included in this order. Homo (man), the Simia, Lemur, and Vespertilio, but it is very doubtful whether many of these Primatés are really superior to many of the other Mammalia. (*See* MAMMALIA.)

PRIMROSE. (*See* next article.)

PRIMULA, *pri'-mu-la* (Lat., *primus*, first, in allusion to its early flowering).—In Botany, the Primrose, the typical genus of the natural order *Primulaceæ*. Calyx tubular, 5-cleft; corolla salver-shaped, tube cylindrical up to the insertion of the stamens; stamens 5, inserted and included in the tube of the corolla; capsules many-seeded, 5-valved, with 10 teeth. Five species of this genus grow wild in Britain:—*P. vulgaris*, the primrose found in woods and hedges, its rich green leaves and delicate brimstone-yellow flowers being often seen long before nature has lost her wintry aspect. *P. vera*, the cowslip, found in pastures and meadows; a fragrant and pretty plant, easily distinguished from the primrose by the smallness of its flowers, and by their forming an umbel. *P. elatior*, the oxlip, found in clayey woods and meadows in the eastern counties. *P. farinosa*, the bird's eye primrose, a rare plant, found in the north of England and south of Scotland, with flowers usually pale lilac with yellow centre. *P. Scotica*, the Scottish primrose, a still rarer plant, with bluish-purple flowers, found on the sandy heaths of the extreme north of Scotland. The beautiful garden-flowers called *polyanthuses* and *auriculas* have been produced by the cultivation of species of this genus. The flowers of the cowslip are sedative and diaphoretic, and are sometimes employed in the manufacture of a soporific wine. (*See* AURICULA and PRIMULACEÆ.)

PRIMULACEÆ, *pri-mu-lai'-se-e.*—In Botany the Primrose family, a natural order of *Dicotyledones*, sub-class *Corolliflorœ*. Herbs with simple exstipulate leaves and regular perfect flowers. Calyx 4—5-cleft, persistent, inferior, or partly superior; corolla 4—5-cleft, very rarely absent; stamens equal in number to the segments of the corolla, and opposite to them; ovary superior or partly inferior, 1-celled; placenta free, central: style 1; stigma capitate. Fruit capsular, with transverse or valvular dehiscence. Seeds numerous, with fleshy albumen; embryo placed transversely to the hilum. The *Primulaceæ* principally inhabit cold and temperate regions in the northern hemisphere. They are very rare in the tropics, being found only on the sea-shore or in mountainous districts. These plants are of little economic value, but many are cultivated for the modest beauty of their flowers. The Auricula, Cowslip, Loosetrife, Pimpernel Polyanthus, &c., all belong to this family. (*See* PRIMULA.)

PRIMUM MOBILE, *pri'-mum mo'-bi-lee.* (*See* PTOLEMAIC SYSTEM.)

PRINCE RUPERT'S DROPS.—Scientific toys which have received this name from Prince Rupert their inventor. They consist of small globules of glass which are dropped when in a melting state, into water, and thus have been suddenly consolidated. In form they somewhat resemble a tadpole, and the thick end may be smartly hammered without breaking, but if the smallest portion of the tail be scratched with a diamond or nipped off, the drop flies at once into fine dust. The reason of this is that the external surface is solidified and cooled much quicker than the interior; hence arises a difference of equilibrium, in regard to the molecular force of the surface particles and those of the interior. When there is a break of continuity at any point the strained molecules are released, and equilibrium is restored.

PRINCE'S METAL. (*See* TIN.)

PRINOS, *pri'-nos.*—A genus of the natural order *Aquifoliaceæ*. The leaves of *P. glaber*, a native of North America, are dried and used as a substitute for China tea, under the name of *Appalachian tea*. The bark of *P. verticillatus*, called *black alder-bark*, or *winter berry*, is employed in North America, in the form of a decoction, as a tonic and astringent. Prinos is the Greek name of the holly, which the present genus much resembles.

PRISM, *prizm* (Gr., *prisma*, a prism).—A solid body whose two ends are any plane figures which are similar, equal, and parallel. The base of every prism, therefore, is equal and similar to any section parallel to the base; and the prism may be considered as generated by the parallel motion of this plane figure. Names are given to particular prisms according to the figure of their bases—as a *triangular* prism, a *square* prism, an *octagonal* prism, and so on. A cylinder, even, may be considered as a *round* prism, or one that has an infinite number of sides. Prisms are also said to be *regular* or *irregular*, according as their bases form regular or irregular polygons. The line supposed to be drawn from the centre of one end of a prism to the centre of the other is called the *axis of the prism*. When the sides and axis of a prism are perpendicular to its ends, it is called a *right* prism; when the sides and axis are oblique to the ends, it is called an *oblique* prism. In Optics, a prism is an instrument used for showing the properties of solar light, and consists of a triangular prism of glass, which separates white light into its component coloured rays while passing through it. (*See* PRISMATIC COLOURS, SPECTRUM.)

PRISMATIC COLOURS. — The colours manifested when a ray of white light is decomposed by passing through a glass prism. They are—violet, indigo, blue, green, yellow, orange, and red. (*See* SPECTRUM, SOLAR.)

PRISTES, *pris'-tees*.—A saw-fish, a selachian of the order Raiæ, having a saw-like appendage proceeding from the snout, which it uses for killing other fish. The common sawfish is found in the Mediterranean. There are about six other species distributed over the polar and tropical seas, but they are seldom seen near the shore.

PRIVET, *priv'-ett* (*Ligustrum*).—A genus of plants of the natural order *Oleaceæ*, all of which grow readily from cuttings. The common privet is a shrub which will grow well in the smoke of towns, and also in the shade of trees.

PROBOSCIDIANS, OR PROBOSCIDEA, *prob-os-sid'-i-ans*.—One of the divisions of the old order of pachyderms now raised by Owen into an order by themselves. They include the fossil mammoth and mastodon, and the living elephant. The chief characteristic is the prolongation of the nose into a trunk. (*See* also PROBOSCIS.)

PROBOSCIS, *pro-bos'-is* (Gr., *pro*, before; *bosko*, I feed).—The term applied to the snout or trunk of an elephant and other analogous animals, and particularly of insects. An elephant's proboscis is a flexible muscular pipe or canal, of about three feet in length, and, correctly speaking, is an extension of the nose. It is with this instrument that he takes his food, and carries it to his mouth. The proboscis of an insect is either used for sucking blood from animals or juices from plants. In conchology, the term proboscis is applied to the tongue of certain gastropods, such as shell-snails, when it is so long as to be capable of being protruded for some distance from the mouth. In such cases the proboscis is used for boring the shells of other testaceæ, and of destroying by suction the soft parts of the animal.

PROBOSCIS MONKEY. (*See* MONKEY.)

PROGNOSIS, *prog-no'-sis* (Gr., *pro*, before; *gignosko*, I know).—The opinion formed respecting the future course of a disease from particular symptoms, as how long it is likely to continue; whether it is likely to terminate in recovery or in death, &c. In one sense, it is not essential to the treatment of the disease, because it relates only to the future; but its value is often great, as it affects the civil and domestic relations of the patient himself. It demands great skill and experience, and even the most skilful, however anxious to allay the fears and anxieties of the patient and his friends, require to speak on such subjects with caution, for no human sagacity can anticipate the numberless influences for good or evil that may come into play during the course of a disease. The principal sources from which the elements of prognosis may be derived are: (1) the disease itself; (2) the peculiarities of the patient; and (3) the external influences modifying both of the foregoing.

PROLAPSUS ANI, *pro-lap'-sus*.—The protrusion of the lower part of the rectum through the anus. It is a very common affection, and is often caused by violent straining at stool, in cases of piles, constipation, &c. The parts should be washed and oiled with sweet oil, and replaced by gentle but firm pressure with the hand; if this is not effective, surgical assistance should be sought.

PROLAPSUS UTERI.—A descent of the womb below its natural position. It is probably due to want of strength in the channel leading from the womb to the exterior of the body, and the family doctor should be at once consulted.

PRONG-HORN, OR PRONG-HORNED ANTELOPE (*Antilope furcifera*).—An antelope found on the great western prairies of North America; it is usually seen in small herds, but sometimes it is found alone. By the Canadian voyagers it was called *Cabrit* or *Cabree*, and by the fur-traders *spring-buck*, and also *Goat*. In general form and gait it resembles the chamois.

PROPOLIS, *prop'-o-lis*.—A resinous substance used by bees to strengthen their honeycombs, and collected by them from the buds of trees. (*See* BEE.)

PROSOPIS, *pro-so'-pis* (Gr., *prosopon*, a mask).—A genus of the natural order *Leguminosæ*, sub-order *Mimoseæ*. The legumes of *P. pallida* and some other South American species are remarkable for their astringency, and have been successfully employed for tanning. In commerce they are known under the names of *algaroba* and *algarobilla*. From the fruit of *P. algaroba* a drink called *chica* is prepared. The name *chica* was first given to a fermented drink prepared from the maize; but it is now used in South America as a common term for several intoxicating liquors.

PROTEACEÆ, *pro-te-ai'-se-e* (after the Greek divinity Proteus).—The *Protea* family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*. Shrubs or small trees, with exstipulate leaves and perfect flowers. Calyx inferior, 4-partite, or consisting of 4 sepals; æstivation valvate. Stamens perigynous, equal in number to the divisions of the calyx and opposite to them; anthers bursting longitudinally. Ovary simple, superior, 1-celled, with one or more ovules, ascending. Fruit dehiscent or indehiscent. Seeds exalbuminous, with a straight embryo and an inferior radicle. The plants of this order are chiefly natives of Australia and the Cape of Good Hope, and are generally remarkable for the beauty or singularity of their flowers, and their rich evergreen foliage. The wood of *Protea grandiflora* is used at the Cape for waggon-wheels; hence the plant is called by the Dutch settlers *wagenboom*. The number of genera is 46; of species, 650.

PROTEIN, *pro'-te-in* (Gr., *proteuo*, I am first).—A peculiar yellowish, horny, semitransparent substance, produced by neutralizing an alkaline solution of any albuminoid compound; such as albumen, fibrin, or casein. According to Mulder, the substance produced from either of these bodies is identical in composition, and he therefore looks upon it as the fundamental principle of the group, giving rise to albumen, fibrin, casein, globulin, vitellin, and legumin, by uniting with various proportions of sulphur and phosphorus. Liebig, and many other chemists of great renown, deny the correctness of this view, and assert that no such body as protein exists. Gerhardt, and some others, consider the so-called protein group as being compounds of a single principle, which presents the character of a weak acid, with various bases and saline bodies. Neither of these hypotheses has as yet been proved to be true; and, in the present state of chemical science, these bodies must be looked on as distinct substances, which are convertible into each other by vital processes taking place in the living organism. The substance obtained by Mulder's process is destitute of taste and smell, insoluble in water, alcohol, or ether, and soluble in the alkalies, which dissolve it on the addition of an acid, re-precipitating it without alteration. The mineral acids cause it to swell up and form a jelly, which retains a portion of the acid employed.

PROTEUS, *pro'-te-us* (after Proteus, the ever-changing sea-god).—One of the genera of those *Batrachians* which preserve their branchiæ throughout life, and which are the sole vertebrated animals that are truly amphibious. The proteus has four feet; there are three toes on the anterior feet, and two only on the posterior feet. The skeleton bears considerable resemblance to that of the salamander; but the proteus has many more vertebræ than the salamander, and less of the rudiments of ribs, and its bony head is entirely different from theirs in its general conformation. But one species appears to be known—the *Proteus anguineus*, which is described by Cuvier as more than a foot long, of the size of a human finger, with a tail vertically compressed, and four little legs; the muzzle elongated and depressed; both of its jaws furnished with teeth; tongue with but little motion, but free in front; eyes excessively small, and hidden by the skin, as in the rat-mole; the ears covered by the flesh, as in the salamander; its skin smooth and whitish. At first view, the animal might be supposed to be a lizard; but it has the motions of a fish. Its head and the lower part of its body and tail bear a strong resemblance to those of the eel; but it has no fins, and its branchial organs form a curious vascular structure, almost like a crest round the throat, which, as the animal is likewise furnished with lungs, may be removed without occasioning its death. Its fore-feet resemble hands, but they have only three claws or fingers, and are too feeble to be of use in grasping or supporting the weight of the animal; the hinder feet have only two claws or toes, and in the larger specimens are found so imperfect as to be almost obliterated. It has small points in place of eyes, as if to preserve the analogy of nature; its two nasal organs, however, are large, and as it is abundantly furnished with teeth, it may be concluded that it is an animal of prey, although, in their confined state, they have never been known to eat, and have been kept alive for many years by merely changing the water in which they have been placed. They were first discovered by a Baron Zöig in subterranean pools in Illyria.

PROTEUS.—Another name for the *Amœba*, certain animalcules belonging to the division *Protozoa*, sub-division *rhizopoda*. The name Proteus has been given because they are remarkable for their changefulness of form.

PROTOCOCCUS, *pro-to-kok'-kus* (Gr., *protos*, first; *kokkos*, berry).—In Botany, a genus of *Algæ*, including several species, which are remarkable for imparting colours to water, snow, &c. *P. atlanticus* gives a red colour to certain portions of the Atlantic; *P. viridis* gives a green tint to snow; and *P. nivalis* a red colour. The blood-red stains produced by the development of the last-named plant are regarded with terror by the superstitious inhabitants of Alpine regions. The plants of this genus are all microscopic.

PROTOGENE, *pro'-to-jene*.—The name given to granite which is supposed to have been first formed. It is constituted much the same as true granite, except that there is talc in it instead of mica.

PROTOPHYTES, *pro'-to-fitez*.—The simplest and lowest organisms in the vegetable world, corresponding to the Protozoa in the animal world. (*See* ALGÆ.)

PROTOPLASM, *pro'-to-plasm*.—The name given to the mucilaginous fluid found in the interior of vegetable cells not occupied by a nucleus. (*See* CELLS.)

PROTOZOA, *pro-to-zo'-a* (Gr., *protos*, first; *zoon*, animal).—A division of invertebrate animals, proposed by Siebold and since adopted by other naturalists. As generally defined, it contains the Foraminifera, Polycisteria, and Rhizopoda generally; the Spongiæ, and the true Infusoria, which may be characterized as having a simple or structureless organization, reducible to a cell, or cell-contents, without any distinct separation of systems of organs. The term is synonymous with Acrita and Aozoa.

PROUD FLESH.—The common name for a growth of coarse and bad flesh or granulations, which sometimes arise on the surface of wounds. It should be cauterized either by nitrate of silver or treated with strong solution of sulphate of copper.

PRUNELLA, *prun-el'-la*.—The name given to certain plants of the natural order *Labiatæ*. The upper lip of the calyx is three-toothed, and the lower lip bifid. Only one species is found in Britain—*Prunella Vulgaris*. It is found in moist, barren spots, and by many people it is commonly called the Self-heal. At one time it had considerable repute as a febrifuge.

PRUNES, *proons*.—The dried fruit of the variety of plum-tree called *Juliana*. This tree is very largely cultivated in France, and the drying and sale of prunes form an extensive trade. It is said that about 500 tons per annum are now sent into England from France.

PRUNING, *proon'-ing*.—The cutting of branches from trees, to improve their appearance, or to cause a greater production of fruit. Some trees will bear cutting much more than others, the rule being that the branches should be cut in proportion to the size of the tree, and that large branches should not be removed, only the twigs and smaller shoots. The habits of each kind of tree must also be studied. Thus gooseberry and black-currant trees produce fruit chiefly on young wood; but cherries, red-currants, and others, principally on shoots from older branches.

PRUNUS, *pru'-nus* (Lat., the Plum).—A genus of the natural order *Rosaceæ*, sub-order *Amygdaleæ* or *Drupaceæ*. The species *P. domestica* and its varieties produce the well-known fruits called plums, greengages, and damsons; *P. spinosa*, the common sloe or blackthorn, is a true native of Britain; *P. institia* is the bullace; *P. Armeniaca* the apricot. The bark of *P. spinosa* has febrifugal properties; the leaves are sometimes used to adulterate China tea. It is said that a mixture of sloe-leaves and the leaves of *Fragaria collina*, or *F. vesca*, in the proportion of one-third of the former to two-thirds of the latter, forms a really good substitute for black tea.

PRURIGO, *pru-ri'-go.*—A troublesome affection of the skin, having for its prominent symptom intense itching. There are three kinds:—*P. mitis*, *P. formicans*, and *P. senilis*. All forms are aggravated by exposure to the air, and also by heat. Great attention should be paid to diet, and also to personal cleanliness. Various local applications have been recommended; perhaps the carbolic acid ointment is the best.

PRURITUS, *pru-ri'-tus.*—The name given to the main symptom of Prurigo—*i.e.*, itching. Sometimes it affects the whole body and sometimes certain parts only. The opium lotion is one of the best applications, and in some cases the wet sheet pack affords the greatest relief. Cleanliness is most essential, and all hot, fiery drinks and stimulating food should be avoided.

PRUSSIC ACID. (*See* HYDROCYANIC ACID.)

PSEUDOSCOPE, *su'-dos-cope.*—An instrument something like the stereoscope, but it causes the parts of bodies in relief to appear hollow, and *vice versa*.

PSIDIUM, *sid'-e-um* (*psidias*, of the ancient Greeks).—A genus of the natural order *Myrtaceæ*. Various species yield excellent dessert fruits, much used in tropical countries, and known as *guavas*. The more important are *P. pyriferum*, *pomiferum*, *cattleyanum*, *albidum*, and *pygmæum*. The first of these bears fruit the size of a hen's egg, yellowish, with a peculiar smell. The rind is brittle, the pulp full of bony seeds, flesh-coloured, sweet, and aromatic. It is commonly eaten raw in the West Indies at the dessert, and also preserved with sugar. *P. cattleyanum* is considered to be one of the best of the guavas; the fruit is of a fine deep claret-colour, and the pulp in consistence and flavour bears some resemblance to the strawberry. Guava jelly is imported into this country, and is much prized as a confection. Guava pulp is employed in the preparation of some of the Indian chutnies or chatnies.

PSITTACIDÆ, *sit-tay'-sid-ee.* (*See* PARROT.)

PSOAS MUSCLE, *so'-as* (Gr. *psoa*, the loins).—A large muscle upon the fore part and sides of the lumbar vertebræ. It bends the thigh forwards, and assists in turning it outwards.

PSORALEA, *sor-a'-le-a.*—A genus of plants of which the *Prairie Apple* of the Canadian boatmen and trappers, and the *Bread-root* of North America, are specimens. They belong to the order *Leguminosæ*, sub-order *Papilionaceæ*. Some are natives of India, and others are indigenous to other warm countries.

PSORIASIS, *sor-i-a'-sis.*—Commonly known as Dry Tetter. It is a dry, scaly disease of the skin, characterized by slightly-raised red patches covered with whitish scales, which often come off in great numbers, so that in the morning the patient may find his bed full of bran-like particles. It is not contagious, and in many cases the application of pitch or tar to the parts affected is sufficient to effect a cure. Small doses of arsenic may be given internally twice a day, but the action of this medicine must be narrowly watched.

PSYCHOTRIA, *si-kot'-re-a.*—In Botany, a genus of the natural order *Cinchonaceæ*. The root of *P. emetica* is called *black* or *striated ipecacuanha*, and possesses similar properties to those of the officinal root (*Cephaëlis Ipecacuanha*), but is less active. The roasted seeds of *P. herbacea* have been used asa su bstitute for coffee.

PTARMIGAN, *tar'-mi-gan* (Gaelic *tarmachan*).—The ptarmigan is the smallest in size of the British grouse, and, as a British bird, is now only found on the summits of some of our highest hills, chiefly in the central and northern parts of Scotland, in the Hebrides and Orkneys, and now and then on the lofty hills of Cumberland and Wales. It pairs early in spring, and lays eight or ten eggs, frequently on the bare ground, among stones, of a yellowish-white colour, sparingly spotted with light brown, and in length one inch eight lines by one inch two lines in breadth. Its food consists of the various sorts of Alpine berries, seeds, and the tender shoots of Alpine plants, and its note or call is not unlike that of the missel thrush, but rather more harsh in sound. It is found on most of the elevated mountain-ranges of the continent of Europe, even to Italy, as well as in Greenland and the northern part of North America, but is nowhere more plentiful than over all the more northern parts of Scandinavia, where it sometimes perches in such numbers in the birch trees, that the latter seem to be altogether clothed in white. In comparatively temperate climates, such as that of Scotland, these birds seem to prefer the bare and stony sides or summits of the highest mountains; but in more rigorous climates, such as that of Greenland, they are chiefly found in the vicinity of the sea-shore, by the banks of rivers, and among the willow and other copsewoods of the lower and more sheltered vales. A remarkable peculiarity of the ptarmigan is the difference between the colour of its plumage in winter and that which it bears in summer. In the latter season, its predominant colours are speckled black, brown, or gray, the male being of a much darker colour than the female; but in winter, the plumage of the male is almost all pure white, and that of the female quite so. The male is about fifteen inches in length, and the female about an inch less. The ptarmigan has been reared in confinement without difficulty, and has been known to breed in a tame state.

PTERICHTHYS, *ter-ick'-this.*—A genus of fossil fishes, found in the beds of the Old Red

Sandstone. The head and upper half of the body were covered with hard ganoid plates, which fitted closely and formed a strong armour. It had certain pectoral spines, which gave it a wing-like appearance, and which caused the name Pterichthys, or wing-fish, to be given to it.

PTERIS, *ter'-is* (Gr., *pteron*, a wing, from the resemblance of its leaves).—Brakes, a genus of ferns. *P. aquilina* is the common branched fern of our woods and heaths. The fronds are tripartite, annual, 1-5 feet high, very much divided, with spreading branches. The capsules (*sori*) are attached to the marginal vein, lying upon a fine membrane, and covered by the membranous continuation of the epidermis. This fern is the only British species of *Pteris*; it possesses anthelmintic properties.

PTEROCLES. (*See* GANGA.)

PTEROCARPUS, *ter-o-kar'-pus* (Gr., *pteron*, a wing; *karpos*, fruit).—A genus of the natural order *Leguminosæ*, sub-order *Papilionaceæ*. The species *P. draco* is one of the plants that yield the *dragon's-blood* of commerce. This is a red resin much used for colouring varnishes and for staining marble. *P. dalbergioides* is said to furnish the valuable dye-stuff called *Adaman redwood*. *P. santalinus* yields the *red sandal* or *sander's wood*, which contains a peculiar colouring matter called *santalin*, and is used in medicine as a colouring agent, and by the dyer for red and scarlet dyes. The bark of *P. flavus* is used in China to produce a yellow dye. *P. marsupium* is the source of the officinal *kino* of our pharmacopœias, which is known under the name of *gum kino*, *East Indian*, *Amboyna*, and *Malabar kino*. It is one of the most powerful vegetable astringents known. *P. erinaceus*, a native of West Africa, yields a similar astringent substance, called *African kino*.

PTERODACTYL, *ter-o-dak'-til* (Gr., *pteron*, a wing; *daktulos*, a digit).—The name of a genus of extinct flying reptiles. From the fossil remains of this animal, it would appear that the second digit of the hand was of great length; and it is believed that this prolonged digit supported a wing-formed expansion of the skin. In speaking of the fossils of the Solenhofen district, where the remains of pterodactyls are found, Cuvier observes that there formerly lived in that canton crocodiles, *Limuli*, and other animals, whose geographical distribution is now confined to the torrid zone. Together with them were these flying saurians, which flitted about by means of the membrane, sustained by a single finger; suspended themselves, and perhaps crept by the aid of the other three fingers; stood upon their hind-legs only; and had their enormous crocodile-shaped mouth armed with small pointed teeth, fit only for seizing insects and small animals.

PTEROMYS, *te'-ro-mise*. (*See* FLYING SQUIRREL.)

PTEROPODA, *ter-op'-o-da*. — The name given to a certain class of molluscs, allied to the *Gasteropoda*, which have, however, wing-like fins by which they make their way through the water. Very few are found on British shores, but immense numbers exist in tropical waters.

PTOLEMAIC SYSTEM OF ASTRONOMY, *tol-e-mai'-ik*.—A term applied to the ancient system of astronomy established by Claudius Ptolemy, a celebrated Egyptian astronomer, who lived at Alexandria during the reigns of Marcus Antoninus and Adrian. He is considered the first astronomer of antiquity. Through him the observations and principal discoveries of the ancients were preserved and handed down. He corrected Hipparchus' catalogue of the fixed stars, and formed tables by which the motions of the sun, moon, and planets might be calculated and regulated. He was the first who collected the scattered and detached observations made by the ancients, and digested them into a system; this he called the *Megale Suntaxis*, or Great Construction, divided into thirteen books. In this work he adopts and exhibits the ancient system of the world, which placed the earth in the centre of the universe; and this has been called from him the Ptolemaic System, to distinguish it from those of Copernicus and Tycho Brahé. The *Megale Suntaxis* was translated by the Arabians into their language about 827, and from this translation, which bears the title of *Almagest*, a Latin version was made by command of the Emperor Frederick II., in 1230. Of this principal work of the great astronomer of the ancients, it may in general be observed that the work is founded on the hypothesis of the earth's being at rest in the centre of the universe, and that the heavenly bodies, the stars and planets, all move round it in solid orbs, whose motions are all directed by one, which Ptolemy calls the *Primum Mobile*, or first mover, of which he dis courses at large. This great work of Ptolemy will always be valuable on account of the observations he gives of the places of the stars and planets in former times, and according to ancient astronomers that were then extant; but principally on account of the large and curious catalogue of the stars, which, being compared with modern catalogues, enables astronomers to deduce the true quantity of their apparent slow progressive motion according to the order of the signs, or of the precession of the equinoxes.

PTOSIS, *to'-sis*.—Paralysis of the upper eyelid, so that it droops over the eye, the patient being only able to raise it by means of his finger. If it arise from brain disease, it will of course disappear only when the greater mischief is remedied, but if it exist without this or similar cause, it may be removed by a surgical operation.

PTYALIN, *ty-al'-in*.—Certain animal matter found in saliva, which has the property of converting foods into sugar. (*See* SALIVA.)

PTYALISM. (*See* SALIVATION.)

PTYCHODUS, *ty-ko'-dus*.—A genus of fish which was supposed to have existed by reason of large square teeth having been found in chalk beds. Large dorsal spines have also been found in connection with the teeth, which seem to have been set as in the Port Jackson shark.

PUBERTY, *pu'-ber-te* (Lat., *pubertas*).—That period of life in which boyhood or girlhood ceases and youth begins. The precise period differs in different countries, being much earlier in southern than in northern climates. The usual period in this country is from the twelfth to the fourteenth year in females, and from the fourteenth to the sixteenth in males. In colder regions, as Sweden, Russia, &c., it does not occur for two or three years later. Various physiological and intellectual changes manifest themselves at this period. The organs of respiration and voice acquire their full tone, the muscles their due proportion, and the cerebro-spinal nervous system its beautiful organization. The child puts away childish things and begins to look upon the world with, as it were, new senses; the mind becomes stored with new ideas, and hope shines over the future. The changes that take place at this period render the individual liable to a variety of diseases, more particularly of an inflammatory nature.

PUCCINIA, *puk-sin'-e-a* (in honour of Puccinius, a Florentine anatomist).—A genus of *Fungi*. The only noteworthy species is *P. graminis*, which produces the mildew of wheat. To prevent the growth of this and other parasitic fungi, wheat is often steeped in some poisonous solution before it is sowed. A solution of sulphate of copper (blue vitriol) has been specially recommended for this purpose.

PUCCOON. (*See* SANGUINARIA.

PUERPERAL CONVULSIONS, *pew-er'-per-al*.—Convulsions which occur before, during, and after child-birth. The spasms are violent, often attended by complete unconsciousness. Their cause is believed to be due to some affections of the kidneys.

PUERPERAL FEVER, *pew-er'-per-al*.—A continued and contagious fever occurring in connection with child-birth. It shows itself within a week or ten days after confinement, and must be distinguished from *ephemera*, or weed, which is a mild form of milk-fever. In some respects it is allied to erysipelas, and those who have been attending such cases have at times given puerperal fever to their patients. It would seem that it prevails epidemically, and that it is more virulent and more likely to occur in lying-in hospitals than in private practice. There is a great variety of views concerning it, due, doubtless, to the varied characteristics of the different epidemics.

PUERPERAL MANIA.—A form of insanity which sometimes occurs during some stage of child-birth. It includes many forms and degrees of mental derangement, but under proper treatment the patient usually recovers.

PUFF-ADDER (*Clotho Aristans*).—One of the most venomous serpents of South Africa. It belongs to the family *Viperidæ*, and has a short, broad, flat head, a length of about five feet, and a thickness about the size of a man's arm. When angry, it puffs out the upper part of its body, hence its name.

PUFF-BALL (*Lycoperdon*).—A class of fungi, of which there are many genera. The largest species found in Britain is the *Giant Puff-Ball*. It is often found many feet in circumference, and when young it is filled with a pulpy mass; but when mature the mass has become dry and sponge-like in character, and has been used for stanching wounds. The com monest British species is, however, the *Lycoperdon Gemmatum*, from one to two and a-half inches in diameter. For the most part, the puff-balls grow on the ground and are round in shape, usually without a stem. When burned, the fumes arising are sometimes used to stupify bees in order to remove the honey, and it is said they have been used as an anæsthetic instead of chloroform.

PUFF-BIRD. (*See* BARBET.)

PUFFIN, *puf-fin* (*Fratercula arctica*).—The generic characters of this singular bird, sometimes called the sea-parrot and coulternab, are, bill shorter than the head, higher than long, very much compressed; both mandibles arched, transversly grooved, notched towards the point; the culmen as high as the top of the head, and with a cutting edge. Nostrils lateral, marginal, linear, naked, almost entirely closed by a naked membrane. Legs short, abdominal. Feet with three toes only, all in front, united by membranes; claws curved. Wings and tail short. Its size is about that of a pigeon or jackdaw, with the upper parts dusky, the lower white, a broad black band round the neck; the bill red, with three grooves across each mandible. It abounds on the northern coasts of Europe and America, where it breeds in burrows formed by itself in the soil of unfrequented islands, making no proper nest. It is only a summer visitor to the British Islands, making its appearance early in April, and departing by the end of August. It visits the Isle of Man, the coast of Anglesey, the high cliffs of the Isle of Wight, between the Needle Rocks and Freshwater Gate, the Yorkshire coast, the Fern Islands, many of the Scottish Islands, and the Sicily Islands, which, in the 14th century, were held under the king, as earl of Cornwall, by Ranulph de Blancminster, for an annual payment of six-and-eightpence, or three hundred puffins at Christmas. Early in May, these birds deposit a single large egg, sometimes in fissures and crevices on the perpendicular surface of the cliffs, at the depth of three or four feet from the front, and sometimes in burrows, for the possession of which they have previously contended with their proper owners, the rabbits. It is two inches three lines in length, by one inch and seven lines in breadth, and when first laid is white, sometimes spotted with pale cinereous, but soon becomes soiled and dirty from its contact with the earth. The young are hatched after a month's incubation, and at the end of a month or five weeks, the long blackish down with which they are at first covered, having given place to the feathered plumage, they are able to follow their parents to the open sea. Soon after this, or about the second week in August, the whole leave our coasts. Puffins walk with a waddling gait, but fly rapidly for a moderate distance, and can swim and dive well. They feed on marine insects, small crustacea, and young fish. An example of the species wanders occasionally, as if by accident, to Sicily and Malta.

PUG, OR PUG-DOG.—A species of dog, something like the bull-dog in form, but much unlike him in temper. The pug is gentle and timid, and is only useful as a pet. It is an affectionate creature, and gifted with great good-nature. The nose is often turned up a little, the skin of yellowish colour with a black snout, and tail firmly curled over the back. Varieties have recently been introduced from China and Japan, some of the latter have long soft hair and a bushy tail, while the Chinese breed has smooth hair, and is very small.

PULMONARIA, *pul-mon-ai' ri-a* (from Lat., *pulmo*, a lung).—This plant is supposed to be so named from its presumed efficacy in disorders of the lungs, or from the spots on the leaves resembling those on certain kinds of diseased lungs. It has a tubular 5-cleft calyx, and a funnel-shaped corolla with a naked throat. The stamens, included in the tube-filaments, are very short; the style is simple, the nuts smooth, attached by their truncate base with a central tubercle. The species are herbaceous plants, with spotted leaves and terminal corymbose racemes of flowers. *Pulmonaria officinalis*, the Lungwort, has ovate leaves, roundish or cordate, the upper leaves oblong; the root is thick and black; the corollas are red before expansion, and then purple. The whole plant is more or less insipid. It is found in the woods and thickets of England, and is a native of Europe and the Caucasus. The leaves, which are the parts of the plant recommended in medicine, have no peculiar smell, but in their recent state manifest a slightly astringent and mucilaginous taste; hence they are supposed to be demulcent and pectoral, and have been prescribed in consumption. All these plants contain nitre in considerable quantities, and when burned this species yields one-seventh of its weight in ashes. In the north of Europe it is eaten as a pot-herb, and, according to Ray, it was brought to table in his time in Scotland.

PULMONARY, *pul'-mon-a-re* (Lat., *pulmo*, a lung).—Denotes of, or belonging to, the lungs; as pulmonary consumption. (*See* PHTHISIS.)

PULMONATA, *pul-mon-ay'-ta.*—An order of gasteropodous molluscs, of which slugs and snails and water-snails are familiar specimens. Their distinguishing characteristic is a vascular air-sac, by which they breathe, and which is capable of being dilated or contracted at pleasure.

PULP, *pulp.*—The soft and succulent substance in the interior of certain fruits, or surrounding certain seeds. In the peach, plum, &c., the pulp forms the mesocarp; in the gooseberry and the grape it is developed from the placentas.

PULQUE, *pul'-kai.*—A favourite drink of the inhabitants of Mexico, as well as of Central and South America, prepared from several varieties of the *Agave Americana* (*see* AGAVE), from the fibres of the leaves of which the Mexicans also make paper. The plant is called *metl* by the Mexicans, and *maguay de Cocicuza* in Caracas. Just before it blossoms, the sap is collected in pitchers by cutting the buds, and is allowed to ferment slightly. In this state it is relished by foreigners, but the natives prefer it when it has passed into its second fermentation, at which time it has an acid taste, and a smell like that of putrid meat. When allowed to ferment still further, it turns into vinegar, and if boiled down becomes syrup. Pulque brandy is made of it, by mixing water and sugar with the sap, and the whole allowed to ferment a few hours.

PULSE, *pulse* (Lat., *pulsus*).—In Physiology, is the alternate expansion and contraction of an artery, occasioned by the propulsion of the blood by the heart, in the form of waves. The pulsations of an artery are nearly synchronous with the contractions of the left ventricle of the heart, the difference, in a state of health, being only from ⅐ to ⅙ of a second, depending on the distance of the part from the heart. The state of the pulse is therefore an indication of the action of the heart and the whole arterial system, of the condition of the blood, and the physical functions in general. It may be felt in any artery, but most conveniently in the radial at the wrist. The pulse varies at different ages and in different states of the system. In the newly-born infant it averages 130 to 140 beats a minute, while in mature life it ordinarily averages from 70 to 75. It is slower during sitting than standing, and slowest during lying; while by inflammatory or acute disease, it may be raised to 120 or even 160 in the adult. Mental excitement, the digestive process, alcoholic drinks, and elevation above the sea, accelerate the pulse. Besides the number of pulsations, their character and the regularity or irregularity of their occurrence are important diagnostic signs. It may be strong or weak, hard or soft, full or small, &c. Galen first drew attention to the pulse as a sign of disease, and enumerated more than thirty different conditions of it.

PULSE (Lat., *puls*).—A term given to the edible seeds of leguminous plants such as peas, beans, lentils, &c., just as *corn* is the term for the edible seeds of grasses, such as wheat, barley, &c. Pulse contains a very nutritious substance called *Legumine*, which, however, forms a thick compound with salts of lime, thus pulse remains somewhat hard if boiled in spring water containing lime.

PULU, *pew'-lew.*—Often called vegetable silk from its beautiful lustre and silky appearance. It consists of the fine hairs from a tree-fern, and has been largely used in Dutch pharmacy as a styptic, but not so extensively used in England. It is imported from Singapore and Owhyhee and other tropical countries.

PUMA, *pu'-ma* (*Felis concolor*, Lin.).—This animal, known also as the American lion, is found not only over a great portion of South America, but extends northwards to the province of Pennsylvania, even making occasional inroads into the state of New York. It is equal to its prototype neither in size, fierceness, nor colour; differing from it especially in the smallness of the head, and the want of mane and tufted tail. It measures about five feet in length, and its tail is long and trailing; its limbs are strong but short, and therefore it stands low. The upper part of the neck and body, and the outside of the legs, are of a deep yellow, tinged with black on the upper parts, by the tipping of the hairs being black; the forehead and upper parts of the head dingy yellow, mingled with gray and black; the under part of the throat, chest, and inside of forelegs, yellowish white; belly white, tinged with yellow; inside of the thighs white, shaded with red and ash; tail yellow, with a black tip and some black hairs on the upper part. Whiskers long, part black and part white; the part of the upper lip on which they are placed, black; the remainder of it, the lower lip, and the throat, beautifully white. The younger animal is marked with indistinct spots, of a deeper tint than the general colour; but these disappear as the animal increases in age. It rather inhabits plains than forests, and approaches near to the habitations of man. It is a cowardly animal, flying at the sight of a human being, and in the north, where it is more timid than in the south, even from the attack of a dog; but it is, at the same time, almost the only animal against which the charge of wanton or unnecessary cruelty can be fairly maintained, habitually killing more animals than it can devour, for the sake of sipping a little of the blood of each. It ascends trees; and its usual method of taking its prey is by lurking in one, and dropping from it as the unsuspicious animal passes by. When taken young, it may be tamed and domesticated like a cat. The Indians employ its coat, which is soft, for clothing, and from it also are made boots and shoes.

PUMICE-STONE, *pu'-mis* (Lat., *pumex*, supposed to come from *spuma*, foam).—In Mineralogy, a porous substance found in volcanic districts. It is a light spongy lava, of a whitish, gray colour, and consists of silica and albumina, with certain percentages of potash and soda. It is so light that it will float upon water. It is used by painters to smooth the surface of their work; it is also employed, in a powdered state, as a polishing material in different branches of trade.

PUMPKIN. (*See* CUCURBITA.)

PUNCH (Hindoo, *pantsh*, five).—A beverage compounded of various ingredients, the idea of which was introduced into this country from Hindostan, where it was so called from being compounded of five ingredients—tea, arrack, lemon-juice, sugar, and water. Various recipes now exist for making this mixture, but alcoholic beverages form the basis. It is usually compounded in a large China bowl, called the punch-bowl, and served into glasses with a ladle. In any form, it is a most unwholesome and intoxicating beverage.

PUNICA, *pu'-ne-ka*.—The Pomegranate, a genus of the natural order *Myrtaceæ*, or, according to some botanists, the type of a distinct natural order named *Granateæ*. *P. Granatum*, the pomegranate, is the *rimmon* of the Bible; it is repeatedly mentioned in the sacred writings. The leaves, the flowers, and the fruit were all used by the ancients for their astringent properties, and the juice of the fruit also in the preparation of cooling acidulous drinks. The rind of the fruit and the bark of the root are commonly used as medicinal agents in this country. They are chiefly employed for their astringent properties, which are due to the presence of tannic and gallic acids. The bark of the fresh root also contains a peculiar acrid principle called *punicine*. The fruit is the only example of the kind, called by botanists the *balausta*. (*See* BALUSTA.)

PUPA. (*See* INSECT-TRANSFORMATIONS.)

PUPIL. (*See* EYE.)

PURBECK BEDS, *pur'-beck*.—Certain strata, chiefly freshwater formations, of the Oolitic Period (which *see*), which have received this name because they have been found well developed in the Isle of Purbeck. They are slightly less than 200 feet in thickness, and exhibit three distinct sets of animal remains, which renders them of great interest, and considerable importance. These three sets have received the names—Upper, Middle, and Lower Purbecks. The Upper are entirely of freshwater formation, chiefly of limestone, and the remains they exhibit are largely those of fish and shells. In the Middle, the remains are much more numerous, and the changes shown are much greater. There are the remains of turtle and various marine shells, &c., also layers of freshwater strata. The Lower Purbecks show traces of a very old and singular vegetable soil, showing stems of coniferous trees. There is also a thin layer showing traces of several species of mammalia. These layers are in the basement bed of the whole group, which consists chiefly of freshwater limestone. Thus in these beds the experienced eye may read strange records of ages ago, and of periods of the world's history long since passed away. (*See* GEOLOGY, OOLITIC PERIOD, &c.)

PURBECK MARBLE.—A freshwater limestone containing a large number of shells, which give it its "figure" when polished, and found in the upper section of the Purbeck beds (which *see*).

PURGATIVES, *pur'-ga-tivz*. — Medicines, the special function of which is to unload the alimentary canal. There are many kinds, some gentle and some violent in their action; some act by increasing the secretion of the bowels, and others by increasing their motion. Rhubarb, senna, aloes, and jalap are included among the ordinary simple purgatives. More powerful purgatives are called *cathartics*, and include colocynth, scammony, castor oil, and podophyllin. There are some purgatives which seem to increase the liquid flow from the bowels: most saline substances, as the tartrate and bitartrate of potash, Rochelle salts, phosphate of soda, Epsom salts (sulphate of magnesia), &c., do this. Many of these, such as jalap and cream of tartar, are combined with advantage; and with the more violent, which gripe severely, it is usual to add some warm or aromatic substances, to prevent griping, such as ginger, peppermint, &c., or sometimes a sedative such as belladonna or hyoscyamus. Some purgatives act specially on the liver. They are called cholagogues, and chief among them are the preparations of mercury (such as calomel), podophyllin, and taraxacum.

PURGING NUT. (*See* PHYSIC NUT.)

PURL, *pu'-rl*.—A drink made by warming a pint of ale, with a quarter of a pint of milk, and adding a wine-glassful of brandy, gin, or rum, and sweetening with sugar.

PURPLE EMPEROR (*Apatura Iris* or *Nymphalis Iris*).—One of the largest and most beautiful of British Butterflies, often seen about the tops of oak trees. The width of the wings from tip to tip measures from 2½ to 3½ inches.

PURPLE WOOD, OR PURPLE HEART.—The interior wood of the trees *Copaifera pubiflora* and *Copaifera bracteata*, natives of British Guiana. It is of a rich purple colour, smooth grained and very hard. Ram-rods for guns are made of it; and as it has the power of standing the shock of violent concussion better than most woods, it is often used and is eminently adapted for the manufacture of gun carriages, &c.

PURPLES, THE, OR PURPURA.—A malady characterized by small, round, purple spots, appearing first on the legs, and afterwards on the arms and body. The causes are obscure and difficult to determine. Usually other symtoms appear (varied in different cases), which guide the physician in the choice of remedies. Thus the disease may be found to be dependent on depressing influences when tonics are required, or the opposite treatment may be found to be necessary; but usually there is much debility. The presence of the spots is due to a small quantity of blood becoming extravasated beneath or even in the skin itself.

PURPURA, *pur'-pur-a*.—The name given to a genus of gasteropodous molluscs, something like the Whelk, but having a smaller shell

They belong to the family *Buccinidæ*. Some species yielded the Tyrian Purple of the ancients. Only one, *Purpura lapillus* is found on British shores.

PURPURINE, *pur'-pur-een.* (*See* RUBIA.)

PURSE-CRAB, (*Birgus*).—A genus of crabs allied to the Hermit crabs, belonging to the order *Decapoda* and sub-order *Anomoura*. The purse-crabs are among the largest of all the crab family, measuring when fully stretched out, from two to three feet. They live near the sea on the East Indian islands, and have a curious habit of digging holes under trees, and accumulating therein large quantities of cocoa-nut fibre, of which stores the Malays are not slow to avail themselves.

PURSLANE, *pur'-slane* (*Portulaca*).—A plant, sometimes cultivated as a pot-herb, and found growing wild on the sea-shore of most of the tropical and sub-tropical countries of the world. The young tender shoots are pickled in France like gherkins. This genus of plants belong to the natural order *Portulaceæ* (which *see*).

PUS, *pus.*—A thick yellow liquid arising from inflammation. It contains a large number of corpuscles, which seem to resemble colourless blood-cells. (*See* also SUPPURATION.)

PUSTULES, PUSTULAR DISEASES.—Pustules may be described as small elevations of the skin containing pus; and pustular diseases, to speak correctly, are those skin diseases such as Acne, Ecthyma, Impetigo, &c., characterized by the presence of pustules. It is true that pustules form during chicken-pox and small-pox, but these are, in fact, febrile diseases.

PUTCHUK, *put'-chuck.*—The root of the *Aucklandia costus*, a native of Cashmere, and possessed of aromatic properties which render it of use as a perfume and as a medicine. It is a staple article of commerce in India, and is largely exported to China, where it is much used for incense.

PUTREFACTION, *pu-tre-fak'-shun* (Fr., from Lat. *putrefactio*).—A process in nature, or species of spontaneous fermentation, by means of which animal and vegetable substances are decomposed and reduced either to their original separate elements, or to much more simple compounds. When nitrogenous organic bodies are exposed to air and moisture at a moderate temperature, they begin to combine with oxygen, and are said to undergo decay. All organic bodies, when life ceases, begin to putrefy with more or less rapidity, according as they contain more or less nitrogen. This putrefaction of animal substances is usually attended by more fœtid and noxious exhalations than those arising from vegetable products, owing principally to the excess of nitrogen in the former. In most cases of animal putrefaction, the formation of ammonia, or of ammoniacal compounds, is a characteristic feature; while other combinations of hydrogen are also formed, particularly carburetted hydrogen, together with several other complicated and often infectious vapours or gases, containing sulphur and phosphorus. By means of chlorine, however, these putrefactive effluvia are easily decomposed or rendered harmless. The process of putrefaction can be counteracted by the abstraction of the air and water, or humidity, or by means of cold, salt, sugar, spices, &c.

PUTRID FEVER. (*See* JAIL FEVER.)

PUZZOLANA, *put-zo-lah'-na.*—An earthy substance of various colours, something like Basalt in its chemical composition, and produced by volcanoes. It takes its name from Puzzuoli near Naples, where it is found in great abundance. The ordinary colours of the Puzzolana found there, are brown and yellow, but in other countries it frequently appears red or gray.

PYÆMIA, *py-ee'-mi-a.*—A dangerous disease, of which the exciting cause is the absorption by the blood, of decomposing animal matter, such as, unhealthy secretions, decomposing pus, putrid fluid from dead bodies, &c. This bad matter may be introduced to the blood by a wound or an ulcer, an imperfectly closed vein as in the case of puerperal fever, after an amputation, or even through a mucous membrane. The poison is rapidly absorbed and diffused (if it takes effect, which is not always the case, unless there are predisposing causes), and the blood quickly deteriorates, passing through certain changes which chemistry has not yet been able to follow. The symptoms now frequently resemble typhoid fever, with which disease pyæmia is often confounded, and death usually supervenes. The treatment should be prompt, and should seek to eliminate the poison. If it has been received through an open sore, the parts should be freely cauterized with nitrate of silver, and then treated with soothing poultices; the bowels may be freely acted on, and the action of the skin increased by diaphoretics; opium has been prescribed to neutralize the depression and irritation of the nervous system, and tonics and a nutritious diet to keep up the strength.

PYCNOGONIDÆ, *pick-nog-on'-i-dee.*—A curious family of spider-like crustacea belonging to the section *Edentata*. They all live in sea-water, some among algæ and some in deep water, and others again are found under stones on the beach. One species, the *Pycnogonom littorale* is not unfrequently found among the seaweeds on British coasts. They appear to feed by suction on molluscs and other marine animals, and the proboscis by which they suck seems to form the whole of their head. But their most curious characteristic is the stomach. This seems to float within the body in a fluid, and from it, ten branches or feelers—five on each side—extend into the legs, two of which, however, are, more properly speaking, pincer-like jaws. These branches, which of course move with the legs, appear to answer all the purposes of the breathing, circulatory and digestive systems in the higher animals.

PYGARG, *pi'-garg.*—An animal mentioned in Deut. xiv. 5, and supposed by some to be the bison, but by others it is believed to be a large handsome antelope called the Addax (which *see*).

PYGMIES, *pig'-miz* (from the Greek word *pygme*, the measure from the elbow to the knuckles).—A fabled race of very diminutive dwarfs, believed in by the ancients. Some of the old writers speak of them as living in the region about the mouths of the Nile, and only a span high, others supposed a race of pygmies to live near the Ganges. Even Aristotle did not regard them as an entirely fabulous race, although he rejected many of the absurd stories told of them, such as that they required ladders to drink from Hercules' goblet. Dr. Schweinfurth speaks of having met with a very small race of men in his African travels in 1868-71. Du Chaillu also speaks of a pygmy race which he found in Africa. They are known as Obongos, and are about 4½ feet high.

PYRACANTHA, *pur-a-kan'-tha.* (*See* CRATÆGUS.)

PYRITES, *pi-ri'-teez.*—The sulphides of iron, copper, cobalt, &c., are termed by mineralogists pyrites, from emitting fire when struck forcibly, or from decomposing spontaneously with the production of heat. Used alone, the term is generally applied to the sulphide of iron, or iron pyrites.

PYRO, *pi'-ro* (Gr., *pur*, fire).—A prefix which, when added to the name of any substance, signifies that its composition has been altered by the application of heat: thus we have pyrogallic, pyrophosphoric, pyromucic, and an infinite number of other acids produced from the original acids by submitting them to the action of heat.

PYROGALLIC ACID, *pi-ro-gal'-ik.*—An important acid formed from gallic acid by the action of heat. Gallic acid, or any vegetable extract containing it, is placed in a shallow iron pan, and covered with a cap of bibulous paper, over which a cover of writing-paper is fixed. Heat is applied to the vessel containing the gallic acid, care being taken not to exceed a temperature of 420° Fahr. The pyrogallic acid sublimes, passing through the bibulous paper cap, and condensing on the outside, being prevented from passing away by the writing-paper cover. Pyrogallic acid has but feebly acid properties—in fact, it is supposed by some chemists to be a neutral body. It forms, when sublimed, brilliant plates, which are freely soluble in water, alcohol, and ether. The solution has a bitter taste, but does not redden litmus-paper. The solution speedily becomes brown from absorbing oxygen from the air, a property so much increased by the addition of free alkali, that a mixture of pyrogallic acid and caustic potash is used for eudiometrical purposes. The principal use of pyrogallic acid is in photography, as a developing agent in the collodion process.

PYROLACEÆ, *pi-ro-lai'-se-e.*—The Wintergreen family, a natural order of *Dicotyledones*, sub-class *Corolliflorœ*. Herbs or under-shrubs, with naked or leafy stems. Leaves simple, evergreen. Sepals 5, more or less distinct, persistent, inferior. Corolla hypogynous, with 4—5 petals, scarcely united at their base. Stamens twice as numerous as the petals, hypogynous; anthers 2-celled, with porous dehiscence. Ovary superior, 4—5-celled. Fruit capsular, dehiscent; placentas axile. Seeds numerous, with a loose testa; embryo minute, at the base of fleshy albumen. There are five genera, which comprise 20 species, natives of North America, Europe, and the northern parts of Asia. They are chiefly remarkable for their tonic, astringent, and diuretic properties. The *Chimaphila umbellata*, wintergreen, or pipsissewa, is an important plant of this order. It has the characteristic properties of the whole family; the fresh leaves are acrid, and when applied to the skin, act as a rubefacient.

PYROLIGNEOUS ACID, *pi-ro-lig'-ne-us* (Gr. *pur*, fire; Lat. *lignum*, wood).—A name formerly given to acetic acid, produced by the dry distillation of wood.

PYROLIGNEOUS ETHER.—A name sometimes used for methylic ether C_2H_6O.

PYROMANIA, *pi-ro-may'-ni-a.*—A morbid tendency to set fire to buildings, &c. A most remarkable instance of this was exhibited in Normandy in 1830, when a large number of barns and vineyards, &c., were burned, and the incendiaries were in every case proved to be young girls, who confessed that they were prompted by strange feelings and sensations, but that they had no sinister motive in what they had done. Usually, however, this insane desire to commit incendiarism is mixed with superstitious or passionate incentives, and, like some other outbursts of mania or frenzy, it has not uncommonly appeared in times of great social calamity, such as famines, plagues, &c.

PYROMETER, *pi-rom'-e-ter* (Gr. *pur*, fire; *metron*, a measure).—An instrument for the measurement of temperatures above those which can be estimated by means of the mercurial thermometer. As mercury boils at 660°, it is incapable of measuring heat above that point. In most common processes, many temperatures are greatly above this point; as, for example, the heat of an ordinary fire and the melting-points of gold and silver. Mr. Wedgwood was the inventor of the first pyrometer. It consisted of small cylinders of Cornwall clay, moulded into fixed sizes and baked at a low red heat. The size of these pieces was such as just to admit them between two square brass rods, fixed on a brass plate, 24 inches long, half an inch asunder at one end, and ·3 of an inch at the other. The brass rods were divided into inches and tenths, making altogether 240 divisions or degrees. On exposing to heat pieces of clay baked in Wedgwood's manner, they contract, and the degree of contraction was believed to be proportional to the temperature. The amount of contraction on exposure to heat was measured on the brass rods, and this indicated the temperature. Thus, if exposed to the heat at which silver melts, it contracted and advanced between the brass rods to 22°, or 2·2 inches; if to the melting-point of gold, 32°; and so on. Wedgwood's pyrometer has, however, been long in disuse, as it was found that the small cylinders of clay, when exposed for a length of time to a low heat, contracted as much as if they had been exposed for a short time to a very high heat. Guyton de Morveau, in 1803, presented to the French Institute a pyrometer of platina, which measured high temperatures by the expansion of the metal; and in 1821 an improvement of this instrument was brought forward by Professor Daniell, of King's College, London. It consisted of a small bar of platina placed in a tube of blacklead or earthenware. The difference of the expansion between the platina bar and the tube is indicated on a circular scale. In this pyrometer, one degree of Daniell is equal to seven degrees of Fahrenheit.

PYROPE, *pi'-rope.*—Also called *Elie* Ruby from being found at Elie, in Fifeshire. A precious stone closely allied to the garnet, and by some lapidaries often called Hyacinth and Carbuncle. It is translucent and of a deep red colour, generally occurring in grains and sometimes in imperfect crystal tubes. It is found in Bohemia and Saxony, as well as at Elie, in Scotland.

PYROPHORUS, *pi-ro'-for-us.*—A term

given to those substances which take fire spontaneously by reason of the rapidity with which they absorb oxygen from the air—*i.e.*, become oxidised.

PYROSIS, *pi-ro'-sis.* (*See* HEARTBURN and WATERBRASH.)

PYROSOMIDÆ, *pi-ros-om'-i-dee.*—The name of a family of marine molluscs, a number of which are often found bound together by their "tunic," an elastic covering of cylindrical form, one end of which is closed. Each individual *Pyrosoma* has its two gills on the outer surface of the cylinder by which it inhales water, expelling it by an orifice in the interior of the cylinder, and by this means a constant stream of water flows through the interior of the cylinder which, meeting with the sea outside as it is expelled, slowly forces the whole group of creatures through the water, the close end of the cylinder foremost. They are frequent in tropical seas, and are often luminous. They form the order *Dactylobranchiata* of Owen.

PYROXENE, *pi-rox'-een.* (*See* AUGITE.)

PYROXYLIC SPIRIT, *pir-ox-i'-lick.*—Also called Methylic Alcohol and Wood Spirit. (*See* METHYL.)

PYROXYLIN, *pi-rok'-se-lin* (Gr., *pur*, fire; *xulon*, wood).—A substitutive compound of explosive character, discovered by Schönbein, formed by immersing cotton, tow, linen, sawdust, or any other form of cellulose, in a mixture of equal measures of oil of vitriol and nitric acid. No apparent change of form takes place, but a very remarkable chemical alteration ensues; a certain number of equivalents of hydrogen are abstracted, and their place supplied by an equal number of equivalents of peroxide of nitrogen; in fact, $C_{36}H_{30}O_{30}$ becomes $C_{36}\underset{9(NO_4)}{H_{21}}O_{36}$. In undergoing this change, the fibre is increased in weight 82 per cent., and acquires new properties. Pyroxylin is specially characterized by its explosibility and solubility in a mixture of ether and alcohol. The former property has caused it to be used in blasting operations, under the name of gun-cotton; the latter has rendered it one of the most important materials used by the photographer. Dissolved in a mixture of ether and alcohol, and mixed with a certain proportion of some soluble iodide, it forms ordinary photographic collodion. Collodion is also used in surgery to form an artificial skin to excoriated surfaces. For this purpose the following process may be employed:—Take of fuming nitric acid and sulphuric acid of each four fluid ounces. Thoroughly saturate half an ounce of clean carded cotton in the mixed acids, having first allowed them to become cool. Macerate for twelve hours, and then wash the cotton in a stream of running water. This quantity of pyroxylin should be dissolved in three parts of ether, to which about two ounces of alcohol have been added. If the film formed is too contractile, a few drops of castor-oil should be added.

PYRUS, *pi'-rus.* (*See* PEAR.)

PYTHON, *pi'-thon.*—A huge serpent. The genus belongs to the family *Boidæ* and all the species are of great size, and are natives of the Eastern Hemisphere. They differ from the true Boas (*see* BOA), in having the scaly plates double on the under surface of the tail. The lips are grooved, and there are plates on the top of the muzzle. They feed on deer and other wild animals, though the larger pythons are said to seize buffaloes, tigers, and even elephants, and twining their huge bodies round them, crush them in their enormous folds. There are immense pythons found in the wild parts of Natal, and also in India and Ceylon, and other parts of the East Indies where they are frequently known by the name Rock Snake. It is said that the body of the Natal Rock Snake is often as thick as that of a man.

Q.

QUADRANT, *kwod'-rant*, (Lat., *quadrans*, a quarter of a circle).—An astronomical instrument used for measuring an arc of a great circle of the heavens, in order to determine the altitude of a celestial body. As its name indicates, it consists of an arc of ninety degrees, which are subdivided into smaller divisions. The quadrant is provided with glasses, attached to a straight rod, through which the heavenly body is to be observed, and the position of which in the graduated arc determines the altitude of the body. As an astronomical instrument, the quadrant has been so completely superseded of late years by the entire circle, that it would be unnecessary in this place to describe particularly either its construction or adjustments. (*See* SEXTANT.)

QUADRANT, in Geometry. (*See* CIRCLE.)

QUADRATIC EQUATIONS. (*See* EQUATIONS.)

QUADRATURE, *kwod'-ra-tewer.*—In Mathematics, the process of determining the area of a square surface, and as this is the simplest measure of surface, it may also be taken to mean the process of determining the areas of curvilinear figures and the volumes of various solids.

Quadrature.—In Astronomy, a term applied to the position of a heavenly body when it is ninety degrees from the sun. It is then said to be in quadrature, ninety degrees being a fourth part of a circle which contains 360 degrees.

QUADRATURE OF THE CIRCLE, *kwod'-ra-ture* (Lat., *quadratura*, squaring).—A speculative problem of great celebrity in the annals of mathematical science. As the whole area of a circle is equal to the rectangle contained by the radius and a straight line equal to half the circumference, the quadrature could be obtained if the length of the circumference were assigned. In attempting to square the circle, therefore, the particular object aimed at is the determination of the ratio of the circumference to the diameter. From the earliest periods, this problem attracted the attention of philosophers, and at the present day, even, there are persons who spend their time and their energies in attempting to overcome the difficulty. The truth is, that such persons do not comprehend the difficulty of the subject. Archimedes in his book on the Mensuration of the Circle, is the first of the ancients who made any approach even to a practical determination of the question. By inscribing and circumscribing a polygon of 96 sides in and about a circle, he shows that the excess of the circumference over three times the diameter must be less than 10·70 parts, and greater than 10·71 parts. This statement is correct, and pretty accurate; for, according to his calculation, a circle of 4,970 feet diameter would have a circumference lying between 15,610 feet and 15,620 feet; the truth being, that such a circle would have a circumference of 15,613¾ feet very nearly. Among the Hindoos the calculation was made much more correctly than by Archimedes.

QUADRUMANA, *kwod-ru'-ma-na* (Lat., *quadra*, *quatuor*, four; *manus*, a hand).—The name of an order of mammalia, comprehending those in which the four extremities are each terminated by a hand; as the ape, baboon, &c. The term four-handed does not, however, apply correctly to all the animals thus called. In the monkeys of the Western Hemisphere, the thumb in the hands or front extremities is wholly, or in part, wanting. Amongst all the species of the quadrumana, there are strongly-marked differences as to the degree in which they resemble man in their general conformation. In some, there is a strong resemblance to him, both in structure, aspect, and gait; whilst others are very slightly removed from the ordinary mammalia. There is, moreover, great variety in their food and habits of life. The larger proportion are gregarious, but some live solitary and others in pairs. Some species dwell on the ground, others inhabit rocky heights, while others live altogether among the branches of trees. With regard to the order of quadrumana, Cuvier remarks that independently of the anatomical details which distinguish them from man, they differ from him in the very striking character arising from their hind feet having free thumbs, which are opposable to the other fingers, whilst those fingers are long and flexible like those of the hand. Consequently, they climb trees with facility; but they do not hold themselves or walk erect except with difficulty, their foot in such cases not resting on the sole, but on its external edge, and their narrow pelvis not favouring equilibrium in that quarter. The whole of the quadrumana are divided into three families or tribes—namely, 1. *Simiadæ*, or monkeys of the Old World; 2. *Cebidæ*, or monkeys of the New World; 3. *Lemuridæ*, or the Lemur tribe. (*See* APE, BABOON, CHIMPANZEE, GORILLA, OURANG-OUTANG, &c.)

QUADRUPEDS, *kwod'-ru-peds* (Lat., *quatuor*, *quadra*, four; *pes*, a foot).—A name formerly given in Natural History to all vertebrate land animals having four feet. The scaly reptiles were called oviparous quadrupeds, to distinguish them from the hairy, warm-blooded, viviparous four-footed mammals. As, however, animals of both these classes, although agreeing in having four legs, differ essentially in many other respects, the term is now popularly limited to four-footed mammals, and is no longer scientifically employed to distinguish any particular class in Zoology.

QUAGGA, *kwag'-ga* (*Equus Quagga*).—This animal, which is an inhabitant of the southern parts of Africa, and bears a great resemblance to the zebra, belongs to one of the six distinct, though nearly allied, species which constitute the genus *Solidungula*, or Horse tribe. It is less than the zebra, with the hinder parts higher and the ears shorter. It measures about four feet in height at the withers. The head, neck, mane, and shoulders are deep blackish-brown, striped with grayish-white lines; the other parts being of a clearer brown, paler beneath, and almost white upon the belly. A black line runs along the spine to the tail. It is a social animal, living in large troops on the karoos or flats of Southern Africa, and frequently pastures in company with the zebra; but no third or intermediate variety has sprung up between them. It is much more docile than the zebra, and is said to be sometimes used at the Cape of Good Hope as a beast of draught or burden. On its native plains, however, it is exceedingly fearless, contending with beasts of prey with much courage and frequent success. Its name *Quagga* is said to be derived from its voice, which resembles the barking of a dog.

QUAIL, *kwaile* (Ital. *quaglia*).—The characteristics of the common quail (*Coturnix vulgaris*) are:—Beak strong, shorter than the head; upper mandible curved. Nostrils basal, lateral, half closed by an arched membrane. Feet with four toes; those anterior connected by a membrane as far as the first articulation. Tail short, rounded, recumbent, almost hid by the tail-coverts. This bird has generally been considered as a summer visitor to England; but recent observations have led to the opinion, that although it is to a certain extent a migratory bird, many of the species remain in England and Ireland throughout the year. Quails arrive from Africa in large numbers on the islands of the Mediterranean and the Grecian archipelago about April, and thence spread over Southern Europe, migrating as far north as Scandinavia and Russia. They arrive in Great Britain in May, and seem more partial to the open country than to that which is enclosed. No individual of the gallinaceous order is so widely distributed over the Old World as the common quail: it is abundant in North Africa, most parts of India, and there is reason to believe, China; while the whole of the southern portions of Siberia, and every country in Europe, except those approximating to the polar circle, are visited by it annually, or adopted for a permanent abode. In England, however, this bird is not very abundant, and the supply for the London market comes principally from France. The males arrive in England and France before the females, and, betraying themselves by their thrice-repeated whistle, are frequently lured within reach of the fowler by the imitation of the female's note on a quill pipe. The flesh of the quail is delicate, and very little inferior to that of the landrail, and consequently it is in great request, as many as three thousand dozen having been sold in London in a single season. Though very like a partridge, and resembling those birds also in several of their habits, quails do not pair, the males being polygamous. For a nest, the female scrapes out a small cavity on the ground, usually amongst wheat, but sometimes in a piece of clover or grass, into which she collects a few bits of dry grass, straw, or clover-stalks. The eggs are of a yellowish or dull orange-coloured white, speckled or blotched with umber-brown, from six to twelve or fourteen in number, and one inch one line in length, by eleven lines in breadth. Upon these the female sits about three weeks; the young are able to follow her soon after they are excluded from the shell, and learn to feed on seeds, grain, insects, and green leaves. The quail is about seven inches in length, and the general colour of the upper part of the plumage is dark brown, mottled and streaked with lighter brown, which is also the colour of the upper part of the breast, whilst the lower part of the breast, the belly, and the under tail-coverts are yellowish white. This bird is historically interesting from the circumstance that there is the strongest ground for believing that it is the identical species which supplied the Israelites with food in the wilderness. There are several other species of quail: such as the rock quail, of Deccan, used for quail-fights by the natives; and the Virginian or Maryland quail, which is a general inhabitant of North America, from the northern parts of Canada and Nova Scotia to the extremity of the peninsula of Florida, the flesh of which is peculiarly white, tender, and delicate.

QUAKING GRASS, *kwaik'-ing.* — A genus (*Briza*) of very beautiful grasses, having drooping spikelets and a loose panicle. Their spikelets tremble in the slightest breath of wind, hence their name. Only one species, the *Briza media*, is common in Britain.

QUAMASH, OR BISCUIT ROOT (*Camassia Esculenta*).—A plant common on the great prairies west of the Mississippi, and closely allied to the hyacinths. The bulbs, when roasted, form a pleasant and nutritious article of food.

QUAQUAVERSAL, *kwa-kwa-ver'-sal* (Lat., turning every way).—A Geological term, indicating that strata incline on every side to one point, either to the summit of a dome if the strata be arranged in dome-like elevations, or to the lowest level if the strata be arranged in basin-like depressions.

QUARRY, *kwor'-re* (Fr., *quarré*, quadrated). —An excavation in the ground from which stone is extracted. The name appears originally to have been applied to such excavations, from the circumstance that the materials obtained from them were quadrated or squared. Great Britain abounds with quarries of nearly every different kind of stone that can be employed with advantage in architecture. The quarries of Aberdeenshire supply large quantities of granite to London every year for bridges, quay walls, and every other work where strength and durability are most needed. In Engand, granite is chiefly quarried in Cornwall. In Yorkshire, Lancashire, and Derbyshire, both red and white sandstone are worked. In England, Wales, and Ireland, there are also extensive slate-quarries. The most common stone that is quarried in England and Ireland is that which is called limestone, and which, from the facility it affords for working, is generally called freestone. It is said that more than 40,000 tons of this kind of stone are annually exported to London from Portland. The marble and limestone quarries which were opened near Plymouth in 1812 furnished the material which was used in building the breakwater of that place.

QUARTAN FEVER. (*See* AGUE.)

QUARTERNARY, *kwor-tern'-a-re.*—The name given by some geologists to the strata formed after the Tertiary period, and ranging in the series Primary, Secondary, Tertiary, and Quarternary. (*See* GEOLOGY.)

QUARTERNIONS, *kwor-tern'-i-ons.*—A method of calculation invented by Sir W. R. Hamilton, and of the utmost value in mathematical analysis, and in solving difficult problems in physics and geometry.

QUARTILE. (*See* ASPECTS.)

QUARTZ, *kwortz* (Ger.).—A mineralogical term for crystallized silica. As a mineral, it is properly colourless; but it occurs also in various shades of colour, forming the amethyst when purple, topaz when yellow, cairngorm when smoke-coloured, and passing, by mixture with other silicious minerals, into jasper, hornstone, chert, flint, chalcedony, agate, and numerous others. Quartz crystallizes in hexagonal prisms with pyramidal summits.

QUASSIA, *kwosh'-ya* (*Quassi*, a slave who first used it as a remedy in malignant fever at Surinam).—In Botany, a genus of the natural order *Simarubaceæ*. The wood of *Q. amara*, a native of Surinam, is intensely bitter, and was formerly much used as a febrifuge and tonic. It is the original quassia of the shops; but it is no longer imported, having been replaced by the wood of *Picrasma excelsa*, a native of Jamaica. The two products are sometimes distinguished as Surinam quassia and Jamaica quassia. The flowers of *Q. amara* are stomachic. (*See* PICRASMA.)

QUEEN OF THE MEADOW. (*See* SPIRÆA.)

QUERCITRON, *kwer-si'-tron.*—The name of the Black Oak (*quercus tinctoria*), and also of the dye made from its bark. (*See* QUERCUS.)

QUERCUS, *kwer'-kus* (Lat.).—The oak, a genus of the natural order *Corylaceæ*, having male flowers in a long pendulous catkin, with 5—10 stamens, and perianth 5—7 cleft; female flowers solitary, with a cup-shaped scaly involucre, 3 stigmas, and a 3-celled ovary. Nut 1-celled, 1-seeded, surrounded at the base by the enlarged cup-shaped involucre. The timber of several species of Quercus is extensively employed for shipbuilding and for other important purposes. *Q. Robur* is the common British oak; there are two varieties of this noble tree, by some regarded as distinct species, called *Q. pedunculata* and *Q. sessiflora*. Besides the British oak, there are the important timber-yielding trees *Q. cerris*, the Turkey or Adriatic oak; *Q. alba*, the white oak; *Q. rubra*, the red oak; *Q. tinctoria*, the black oak; and *Q. virens*, the olive oak. The bark of several species is astringent and largely employed for tanning purposes, and to some extent in medicine; that of *Q. pedunculata* is most esteemed. The outer bark of *Q. Suber*, the cork-oak, constitutes the *cork* of commerce, an invaluable article, for which there is no fitting substitute. The bark obtained from the younger branches of the same tree is imported into this country from Spain, and employed in tanning, under the name of *European alcornoque bark*. The inner bark of older stems is also imported as *cork-tree bark*, and employed for similar purposes. The acorn cups of *Quercus Ægylops* are called *valonia*; the dried half-matured acorns, *camata*; and the very young ones, *camatina*. These three articles are very valuable for their tanning properties, and are imported in large quantities from the Levant. The bark of *Q. tinctoria*, the black oak, is called *quercitron bark*, and is much used for tanning; its inner portion is also extensively employed in this country for dyeing yellow. *Q. coccifera*, the Kermes oak, has its young branches attacked by a species of *coccus*, which forms little reddish balls upon their surface. These were formerly much used as a crimson dye. Oak-trees are especially liable to be attacked by insects, and the excrescences which are produced are commonly called *galls*. The more important galls are the *nut-galls* of commerce, and the large *Mecca* or *Bussorah galls*, called also *Dead-Sea apples*, *mad apples*, and *apples of Sodom*. The latter are produced by the *Cynips insana* on the *Q. infectoria*. The former are also produced on the branches of the same tree by the *Cynips gallæ tinctoriæ*, or gall-insect. They are extensively employed in tanning, for making ink, and for other purposes in the arts. The best come from the Levant. Two kinds are specially distinguished—the *blue* and the *white*. The dark-coloured imperforate galls are the most valuable. The acorns of some species of *Quercus*, as *Q. Ballota*, *esculenta*, and *Hindsii*, are edible.

QUICKENS, *quick'-ens*. (*See* COUCH GRASS.)

QUICK-MATCH.—A fuse or match used for exploding mines, &c., and made by soaking cotton wick in a mixture of vinegar and saltpetre, gunpowder being sometimes added.

QUICKSILVER. (*See* MERCURY.)

QUILLAIA, *kwil-lai'-ya*.—A genus of plants of the natural order *Rosaceæ*. The bark of *Q. saponaria* and other species contains a large proportion of *saponine*, and is employed in some parts of America as a substitute for soap. It has lately been used in this country as a detergent in cases of scurfiness and baldness of the head.

QUILTOR, *kwil'-tor*.—A complaint sometimes affecting the top of a horse's foot. It is fistulous in its character, and caused by neglected corns, &c., which lead to the formation of bad matter under the hoof. An outlet must be made for the egress of bad matter, and poulticing and a mild astringent lotion applied.

QUINCE. (*See* CYDONIA.)

QUINIC ACID. (*See* KINIC ACID.)

QUININE, OR QUINIA, *kwe-neen'*, *kwin'-e-a*.—In Chemistry, an alkaloid found in the bark of trees belonging to the Cinchona or Peruvian Bark family. Besides quinine, these barks yield five other similar alkaloids; but as they are not used to any extent either in medicine or manufactures, it will be necessary to only enumerate them. They are cinchonine, cinchonidine, cinchonicine, quinidine, and quinovine. Besides these, the bark of the *Cinchona ovata* yields *aricine* or *cinchovatine*. Quinine occurs most in the yellow bark, or *Cinchona cordifolia*, in which it occurs with cinchonine, in combination with kinic and kinotannic acids. The quantity varies, in different specimens of bark, from 3 to 5 per cent. The bases are extracted by boiling the pulverized bark in 8 or 10 parts of water, acidulated with one part of oil of vitriol and 1 of hydrochloric acid. The liquor is strained through a cloth, and again treated with acidulated water. As soon as the liquors are cold, milk of lime, or carbonate of soda, is added, the precipitates formed being submitted to pressure and treated with hot alcohol. If cinchonine be present in any quantity, it crystallizes as the liquid cools, and the two alkaloids are further separated by the addition of dilute sulphuric acid and crystallization, the sulphate of quinine crystallizing out first. The alkaloid is thrown down by the addition of ammonia, and may be formed into the different salts at will. Quinine being very insoluble in water, it is generally used in medicine in the form of disulphate, which dissolves readily in alcohol and water. Quinine is one of the most valuable febrifuges and anti-periodics that we possess. Cinchona plantations have been formed in various parts of British India, from which we obtain a large supply. Plantations are also found in Guatemala and Mexico. (*See* CINCHONA.)

QUINOA. (*See* CHENOPODIUM.)

QUINSY, OR CYNANCHE, *kwin'-se* (corrupted from Fr., *esquinancie*, Lat. *cynanche*).—In Medicine, is an inflammation of the throat. Medical men distinguish it into different kinds, according to the nature of the inflammation, or the part chiefly affected; as croup, diphtheria, pharyngitis, tonsillitis, &c. The two former are noticed under their proper heads, the latter are those that commonly come under the head of quinsy. They do not differ materially from each other either in character or in the mode of treatment, but in the one case the pharynx is the principal or sole seat of the disease, in the other, the tonsils. The inflammation is brought on by cold, and it usually commences with cold chills and other febrile symptoms. There is fulness, heat, and dryness of the throat, with a hoarse voice, difficulty of swallowing, and shooting pains towards the ear. The inflammation may be confined to the pharynx, or it may spread from it over the soft palate and the tonsils, and into the cavities of the nose. On examination, the back of the mouth and fauces will be found unnaturally red and swollen, and often covered with a tough mucus. In general, a common sore throat does not require much treatment, the inhaling of the vapour of hot water, or a large poultice round the throat, with gentle purgatives, and the avoidance of stimulating food, being usually all that is necessary for its removal. Frequently, however, the swelling continues for some time, and occasionally the disease takes the form of relaxed sore throat, which requires to be treated with stimulating gargles, as hot wine, very diluted mineral acids, &c., and tonics, if the general health be not good. In more severe cases, the difficulty of swallowing is much increased, and to avoid the pain, the patient usually allows the saliva to flow from his mouth, and liquids attempted to be swallowed return through the nose. The inflammation may also extend to the Eustachian tube, producing deafness, and to the parts around the larynx, occasioning difficulty of breathing. With these symptoms there is usually a considerable degree of fever, with headache, loss of appetite, &c. In such cases, strong purgatives are required, with a blister outside the throat, and warm poultices, the inhaling the steam of hot water, stimulating gargles, and if the throat be much swollen, leeches applied to the sides. Sometimes an abscess is formed in one or both tonsils, from which the patient suffers greatly. This will in time burst; but it will materially shorten the patient's sufferings if it be opened as soon as the matter is distinctly formed. After the inflammatory symptoms have subsided, a generous diet and tonic medicines are necessary. Where the tonsils have become permanently enlarged, or where other means fail, it is sometimes necessary to reduce them by cutting to their natural dimensions. In malignant or putrid sore throat there is great prostration of strength, accompanied with a low typhoid state, requiring the remedies used in low typhus, with astringent gargles, leeches, and nutritive diet, &c.

QUISCALUS, *kwis'-ka-lus*.—The name of a genus of birds something like the Starling and belonging to the family *Sturnidæ*, from the peculiar shape of the tail, the centre feathers of which are longest. Some of them are called *Boat-tails*. The commonest and most numerous species is found in America, where it is known as the Crow Blackbird, and also the PURPLE GRAKLE. Another species, the Great Boat-tail, is common in the Southern States.

QUITCH, *kwitch*. (*See* COUCH GRASS.)

QUOTIDIAN FEVER, *kwo'-tid-i-an*. (*See* AGUE.)

R.

RABBIT, *rab'-bit* (said to come from the Belgic *robbe*, *robbeken*).—This animal (*Lepus cuniculus*), now so common throughout the southern and temperate parts of Europe, is supposed to have been of African origin, and first imported into Spain. It belongs to the same genus as the hare, and resembles it in form, but differs from it considerably in its gregarious habits, its subterranean life, its whiter flesh, and less perfect state of the young when produced, these being blind at their birth and nearly naked. It is very prolific, breeding seven times a year, and bringing five young ones each time. The rabbit affects a temperate and warm climate, and bears great cold with difficulty. In Sweden they are obliged to be kept in houses. In England they are most plentiful in the counties of Lincoln, Norfolk, Suffolk, and Cambridge, where the soil is sandy, and whence they are brought in immense numbers for the supply of the London market. Rabbits have been known from the earliest periods of history, and the first or earliest accounts which we have of them represent them as inhabiting the warm and sandy places of southern climates, especially those near the shores of the sea. It has been introduced in recent times into America, and having found in the more southern portion of that country a climate very congenial to its constitution, has increased rapidly. The rabbit in a natural state has the ears shorter than the head, and the tail is not so long as the thigh. The general colour in a state of nature is yellowish-gray, reddish on the neck, and brown on the tail, with the throat and belly whitish. The ears are gray. There are four varieties of rabbits, differing somewhat in their characteristics and habits: namely, the *warreners*, *hedgehogs*, *parkers*, and *sweethearts*. The first kind, as their name implies, are in the habit of making their homes or burrows in open grounds or warrens; the *hedgehogs* are found in thick hedgerows and wood covers in parts where the soil is not sufficiently sandy to be made a subterranean dwelling, and the coat of them is less furry than that of the others; the *parkers* live on the upland also, as in gentlemen's parks, pleasure grounds, and broad open grazing grounds, and breed in any convenient spot, and, except to the eye of a professional warrener, are undistinguishable from the last variety; *sweethearts* are the tame varieties, and now multiplied into innumerable varieties of size, colour, and character, from the olden to the lop-eared, and from the middle-sized to the monster of ten pounds weight. When only five or six months old, rabbits are capable of breeding, their term of gestation being thirty or thirty-one days. If the dam does not find a hole suited to her purpose previously to her bringing forth, she digs one, not in a straight line, but in a zig-zag direction, enlarging the bottom of it in every way, and pulling from her own body a quantity of hair, with which she makes a warm and comfortable bed for her young. When she ventures abroad, she covers up the hole very carefully, scarcely leaving any perceptible mark of it, and conceals her charge from the male, it is said, lest he should devour them. She continues these attentions for about a month, when the young are able to provide for themselves. The ordinary term of a rabbit's existence is from seven to ten years. As rabbits cannot articulate sounds, and are formed into societies living under ground, their method of giving an alarm is very peculiar; for when any danger threatens, they thump the earth with one of their hinder feet, and produce a sound which can be heard by animals near the surface at a considerable distance. They are very sensible to any changes of the weather, and seldom go abroad unless it be settled and calm.

RABIES, *ray'-bi-ees*.—A terrible disease to which the lower animals, but more particularly dogs, are subject. It was known to the ancients, but appears then to have been less virulent in its character, if accounts concerning it are to be trusted; and Aristotle is reported to have said that many were not subject to its attacks. It is still a matter of dispute as to whether the disease is caused by blood-poisoning, or whether it is an affection of the nervous system, also whether it occurs spontaneously in some of the lower animals, or whether it is only communicated by inoculation. (*See* HYDROPHOBIA.)

RACAHOUT, *ray'-ka-hoot*.—The name of a farinaceous food said to consist of the ground-up acorns of the Barbary Oak, flavoured with an aromatic herb. It is imported from the coast of Barbary.

RACE HORSE.—A breed of horses usually longer in body than other breeds: they are trained for racing, and noted for their great swiftness. (*See* HORSE, HORSE RACING.)

RACEME. (*See* INFLORESCENCE.)

RACEMIC ACID, *rase'-mik* (Lat., *racemus*, a bunch or cluster).—A peculiar modification of tartaric acid, found in certain species of grape growing in the Vosges mountains, and in one or two other localities. It differs from tartaric acid in certain minor particulars, although its composition is precisely similar.

RACEMOSE CYME. (*See* INFLORESCENCE.)

RACES, *rai'-ces* (Fr.).—Those permanent varieties of species which can be propagated by seed. Familiar examples are afforded by our cereal grains (wheat, oats, barley, &c.), and by our culinary vegetables (peas, lettuces, radishes, cabbages, cauliflowers, &c.). Such permanent varieties, however, require to be kept up by cultivation, for if left to themselves, or sown in a poor soil, they will soon lose their peculiarities, and either perish or return to their original specific type.

RACES OF MANKIND. (*See* ETHNOLOGY.)

RACHIS, *rah'-kis.*—Literally, the spine or the back-bone. The term is applied in botany to the prolongation of the stem or branch from which the flower-stalks rise.

RACHITIS, *rah-key'-tis.* (*See* RICKETS.)

RACOON, OR RACCOON, *rak-koon'.*—The name of genus of a quadrupeds (*Procyon*) found in North America, classed as belonging to the bear family. They differ, however, in some important particulars, the dentition being different, and they are also less plantegrade. In fact, the racoon may, perhaps, be best described as a fox-like creature with the gait of a bear. The head is round, with a narrow tapering nose, projecting beyond the mouth, black at the end, and flexible; the lips black. Eyes moderately large and round, with a circular pupil. Elliptical ears, low but erect, with rounded tips, dirty-white. Whiskers strong. Short-haired muzzle, dirty-white, the colour extending round the cheek and over the eyes. Back grizzled. Belly paler than the back. Tail bushy; not unlike a fox's brush, dirty-white, annulated with dark rings. Length of head and body, two feet; of tail (*vertebræ*), 9½ inches. It is a native of the north of America, and, according to some authorities, extends as far south as Paraguay. In a state of nature, it sleeps throughout the day, prowling during the night in search of fruits, roots, birds' eggs, and insects. At low-water it frequents the sea-shore, where it preys on crustacea and shell-fish. It climbs trees with great facility. Its sagacity is considerable; but as it is not very powerfully armed, it is not very courageous, and seldom approaches dwellings with the same hardiness as animals decidedly carnivorous.

The Crab Racoon (*Procyon cancervorius*), is an inhabitant of the warmer parts of South America, and is rather a larger animal than the common racoon; but the characteristics of each are very similar.

RACOONDA, *rak-koon-da.*—The name sometimes given to Coypu fur. (*See* COYPU.)

RADIATA, *ray-di'-ayta.*—A name given by Cuvier to the lowest of the four great divisions into which he arranged the animal kingdom. He gave them this name because their organs of motion and of feeling are disposed like rays around a centre. Under the head *Radiata*, he collected together a most heterogeneous assembly of the lowest animals, such as intestinal worms, sea nettles, &c., and then divided them again into five classes. Professor Huxley calls them "The Radiata Mob," and they have now been all completely re-arranged. They will be found described under their various names.

RADIATION OF HEAT. (*See* HEAT and LIGHT.)

RADICLE, *rad'-i-kl.*—In Botany, that portion of the embryo from which the root is developed.

RADICLE THEORY, *rad'-i kl* (from Lat., *radix*, root).—The theory of compound radicles in organic chemistry, first proposed by Liebig, may be best illustrated and explained by considering the composition of the alcohols. Thus, in the case of ordinary vinic alcohol, $C_4H_6O_2$, Liebig assumed that it was a derivative of a radicle C_4H_5, which he named ethyl. In like manner he considered ether, C_4H_5O, also to be derived from the same radicle. Upon this theory, which, as soon as it was started, received the fullest confirmation from thousands of experimenters, the compound group ethyl, C_4H_5, performed a similar function to potassium, silver, or any of the other elements. Taking potassium as an example, the compounds of the two radicles would run as follows:—

Oxide of potassium,	KO	Oxide of ethyl	$(C_4H_5)O$
Chloride of do.	KCl	Chloride of do.	$(C_4H_5)Cl$
Iodide of do.	KI	Iodide of do.	$(C_4H_5)I$
Sulphide of do.	KS	Sulphide of do.	$(C_4H_5)S$
Hydrated oxide of do.	KO.HO	Hydrated oxide of do.	$(C_4HS)O.HO$

The theory was at first strongly objected to by many eminent chemists, from the circumstance of the assumed radicles being hypothetical; but as experiments went on, first one and then another of these radicles were isolated, until at last a very respectable list was shown. Similarly, the theory was extended to the organic acids, acetic acid having been shown to be a hydrated oxide of the radicle, thus assimilating them to the inorganic acids, as shown below:—

Formic acid, $HO(C_2H)O_3$, or hydrated teroxide of formyl (C_2H).

Acetic acid, $HO(C_4H_3)O_3$, or hydrated teroxide of acetyl.

Sulphuric acid, $HO.SO_3$ is hydrated teroxide of sulphur.

RADIOLITES, *rad-i-o'-ly-tees.*—A genus of mollusca, of which nearly fifty species have been discovered. They are remarkable for the diversity of their valves, and are only found in Cretaceous rocks. They are Lamellibranchiate.

RADISH. (*See* RAPHANUS.)

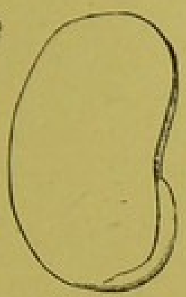
RAFFLESIA, *raf-feel'-shi-a.*—A genus of parasitic plants, belonging to the *Rhizogens* (which *see*), and found in South America and in the East Indian Islands. These plants have neither stalks or leaves, but consist of a flower issuing directly from the root. The flowers first appear as a swelling on the root, and when the bark of the root has broken, the swelling grows into a large flower something like a cabbage. The largest species (*R. Arnoldi*) is quite 3 feet in diameter. Another species, however, found in Java, is only 3 inches in diameter. Some of the species are largely used a styptic.

RAGGEE, *rag'-gee.*—A cereal (*Eleusine corocana*) found in Hindostan, and when made into bread and porridge, the principal food of the poorest classes in some districts of India. It is perhaps the least nutritious of all the cereals.

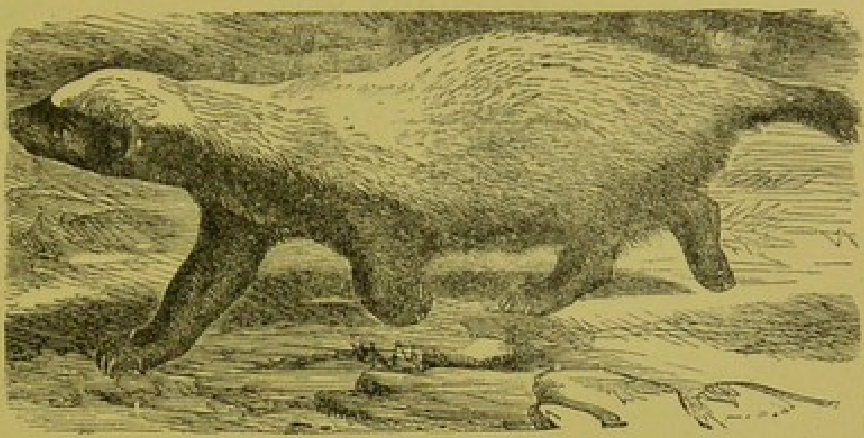
RAGOUT, *ra'-goo.*—A dish of highly-seasoned stewed meat and vegetables, from the French verb *ragouter*, to excite or revive the appetite. The Spanish dish *olla* and the Turkish *pilaû* are very much the same sort of thing.

RAG-STONE.—The name given to an impure limestone much used for building purposes.

RACEMA.

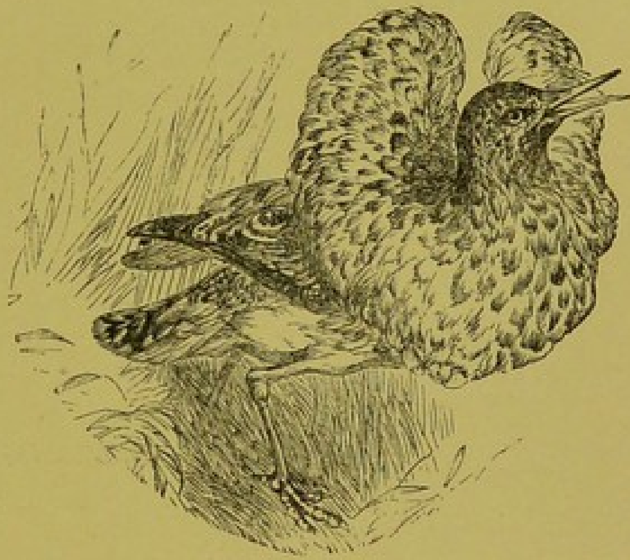


RADICLE.

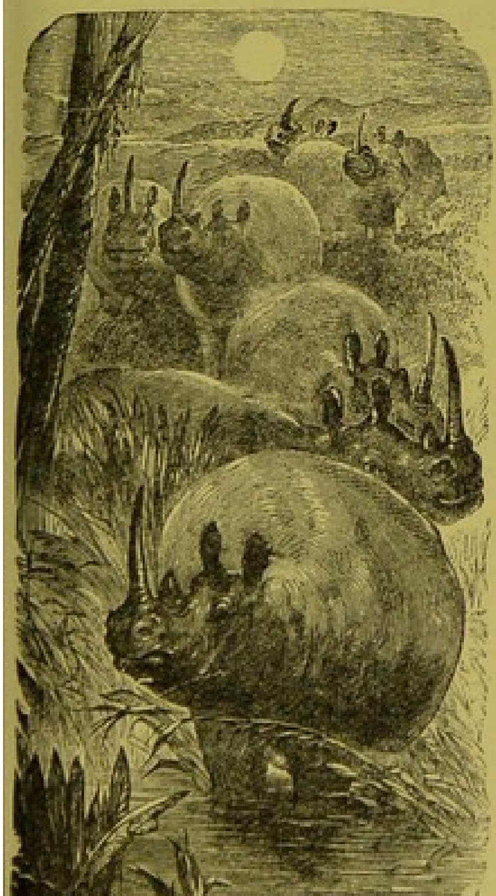


RATEL.

REDWING.



RUFF.



RHINOCEROSES.

SECRETARY BIRD.

It consists principally of lime and silica, though the name is also applied to any hard rock found overlying better stone.

RAGWORT.—The common name of certain weeds with large yellow flowers and ragged leaves, hence the name—far too plentiful and quick-growing in many British pastures. They belong to the *Senecio*, and the characteristic features are that the flowers have a spreading ray and the leaves are pinnatifid, there being small scales at the base of the involucre. One species, the Common Ragwort, is the *Senecio Jacobæa;* it is perennial and much disliked by cattle. Happily, it will generally disappear from well-drained soil.

RAIL, *rayl* (*Rallus*).—The name of a genus of birds belonging to the family *Rallidæ* and order *grallæ*. Only one, the Common Rail or Water Rail, is found in Europe or Britain; but a number of different species are found in America. In all of them the bill is slender and long, and the body compressed. They are found in marshy situations, where they live among the reeds, and frequently escape observation by reason of their olive brown plumage. They feed on worms, &c., and vegetable substances, and the flesh of all species is highly esteemed for the table.

RAIN, *rain* (Sax. *rægn*).—When the air can no longer retain the moisture blended with its particles, the water descends in drops upon the earth, purifying the atmosphere through which it falls. The vapour thus condensed is called rain. The moisture in the atmosphere is derived from the evaporation of water, partly from land, but principally from the surface of the ocean. Continual evaporation goes on from the surface of lakes, pastures, cornfields, and forests; and as much moisture will be supplied to the air by a ploughed field as by a sheet of water of equal dimensions. Through this surface-evaporation the air becomes quite damp; but in being transported to a warmer situation it may afterwards become dry. This is the case with a sea-breeze in summer. When it touches the shore, it is cold and moist; but as it proceeds inland it grows milder and drier. When moisture is deposited by a body of air in minute globules, which remain suspended or subside gradually in the air, it is termed a *cloud;* when it comes near us and hovers on hill-tops and hangs in valleys, it is called a *mist* or *fog*. The true theory of the production of rain was first discovered by Dr. James Hutton, of Edinburgh, in 1787. Rain-water, or melted snow, is the purest of all natural waters, though, in consequence of its solvent powers, it generally contains some extraneous ingredient. The amount of rain which falls upon the earth is greatest in the tropics, and decreases as we approach the poles. The quantity of rain falling at a certain place, however, is considerably influenced by the physical features of the locality. Thus there is a striking difference between Kingston, Jamaica, and St. Domingo, both in the West Indies; between Liverpool and Kendal; between Glasgow and Greenock; and generally between the opposite coasts of Great Britain. On account of this fact, together with the action of prevailing winds and seasonal peculiarities, the surface of the globe has been divided by meteorologists into *hyetographic* regions. Thus between the tropics of Cancer and Capricorn there is a zone of *periodic rains*, and external on either side zones of *constant precipitations*. Within the tropics, also, there is the striking peculiarity of dry and rainy seasons, depending on the position of the sun and the direction of the wind.

RAINBOW.—The brilliantly coloured bow or arch which appears in the region of the sky opposite to the sun when rain is falling and the sun shining at the same time. When perfect, this well-known meteor presents the appearance of two concentric arches, the inner being called the *primary*, and the outer the *secondary*, rainbow. In each arch are to be seen the colours of the solar spectrum; the tints, however, are arranged in reverse order. In the primary arch the red forms the exterior ring, and in the secondary the interior ring. So early as the 16th century, a scientific explanation of the rainbow was proposed by Maurolycus of Messina; but the theory was correct only as far as to attribute the phenomenon to the reflection of the sun's rays by the rain-drops falling from the clouds upon which the arch is projected. About two centuries before that time, however, a Dominican friar named Theodoric anticipated Maurolycus: his manuscript bears the date of 1311. For the production of the rainbow, the coexistence of the following circumstances is always necessary:—The sun's rays must impinge on the falling rain; the sun's altitude must be less than 45°, and the spectator must be interposed. A line from the sun to the centre of the arch passes through the head of the spectator, consequently each views his own rainbow. In the phenomenon of the rainbow, the rain-drop represents the prism (which *see*), and the dark background the screen upon which the spectrum is projected. Besides the primary and secondary rainbows, we sometimes meet with *supernumerary* or *supplementary* arches, depending upon the peculiarities in the atmosphere favourable for their development.

Lunar Rainbows do not differ in the theory of their formation from solar rainbows, but they are less bright, of a whitish colour, and occur but seldom.

RAIN-GAUGE.—An instrument for measuring the quantity of rain that falls. It is constructed in various ways; but one of the best is a hollow cylinder, having within it a cork ball, and attached to it a wooden stem, which passes through a small opening at the top, in which is placed a wide funnel. When placed in a free situation in the open air, the rain that falls within the circumference of the funnel flows into the cylinder, and causes the cork to float; and the quantity of water in the cylinder may be seen by the height to which the stem of the float is raised. The stem of the float is so graduated that its divisions show the number of perpendicular inches of water which fell on the surface of the earth since the last observation. In fixing these gauges, care must be taken that the rain may have free access to them. For this reason, the tops of buildings are the best places. The following short list will show the annual depth of rain in different latitudes, as taken by rain-gauges:—Grenada, 12°, lat. N., 126 inches fall of rain; Calcutta, 22° 23', lat. N., 81 inches; Rome, 41° 54', lat. N., 39 inches; England, 50° to 55°, lat. N., 31 inches; St. Petersburg, 59° 16', lat. N., 16 inches.

RAIN PRINTS.—The name given to small depressions, believed to be caused by rain-drops, on the surfaces of some argillaceous rocks. (*See* ICHNOLOGY.)

RAISINÉE, *ray-zin'-ay.*—A French sweetmeat, made by boiling and skimming new wine or cider until half has evaporated, and then simmering quarters of apples in the residue.

RAISINS. (*See* VITIS.)

RALLIDÆ, *ral'-li-dee.*—The name of a family of birds to which the rails, coots, crakes, &c., belong. (*See* those headings.) The characteristic features are a long compressed bill, with the tip more or less curved; the tail short; wings short, so they do not fly well; body somewhat narrow and compressed, so that they are fitted for gliding through reeds, as the coot and rail, or through long grass as the landrail or corncrake; the legs and toes are slender and long, and the hind toe is level with the others; the toes of the coots have a membranous margin.

RAMBUTAN. (*See* NEPHELIUM.)

RAMENTA, *ra-men'-ta* (Lat., scrapings, shavings).—In Botany, the scale-like hairs so abundant on ferns. They consist of cells combined so as to form brownish flattened scales attached by their base to the surface of the epidermis.

RAMIFICATION. (*See* BRANCH, BUD, STEM.)

RAMPHASTIDÆ. (*See* TOUCAN.)

RAMPION, *ramp'-i-on.*—A rare plant (*Campanula rapunculus*), now in England, but common in France, where its roots, which are something like small turnips, and its young leaves, are used as food. Formerly it was used in England also for this purpose. It is a perennial, growing about two feet high, and having pretty blue flowers growing from the stem. (*See* CAMPANULA.)

RAMSKIN, *rams'-kin.*—A kind of cake, made with fine puff-pastry and hard grated cheese, and usually eaten hot. It is cut into various shapes, glazed with the white of an egg, and baked for a quarter of an hour. These cakes are sometimes called "Sefton Fancy," because they are believed to have been first made at Lord Sefton's seat, Croxteth Hall.

RAM-TIL.—A plant largely cultivated in Mysore and also in Abyssinia for the seeds, from which a bland oil is obtained. This oil is used for much the same purposes as olive-oil. The plant belongs to the natural order *Compositæ*, sub-order *Corymbiferæ*, and its botanical name is *Guizotia oleifera.*

RANA, OR RANIDÆ. (*See* FROG.)

RANK, RANKNESS.—Excessive growth in vegetables, trees, &c., usually attended with diminished productiveness of fruit or grain; and in the case of grass or other herbage, with deficiency in nutritive qualities. It appears to be due to an excessive quantity of Chlorophyll (which *see*) owing to unwise manuring of the ground.

RANULA, *ran'-u-la.*—An encysted tumour, usually frog-shaped (hence the name, from *Rana*, a frog), and lying under the tongue. It contains a glairy fluid, and the treatment usually consists of making a free incision and touching the interior with nitrate of silver.

RANUNCULACEÆ, *ra-nun-ku-lai'-se-e* (Lat., *rana*, a frog, because it grows where frogs abound).—In Botany, the Crowfoot or Buttercup family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*. Herbs with alternate or radicle leaves, or in one genus climbing shrubs with opposite leaves, the leaf-stalk in both cases generally dilated at the base, without stipules, the leaf often much divided, and the flowers solitary or in terminal racemes or panicles. Calyx of 3—6 (usually 5) distinct sepals. Corolla of 3—15 distinct petals (usually 5), generally regular, but sometimes irregular, very minute or altogether wanting. Stamens indefinite, usually numerous, inserted in the receptacle. Carpels numerous, distinct, one-celled, or united below so as to form a compound many-celled ovary; one or many ovules attached to the ventral suture; style simple. Fruit consisting of a number of achænia, or of several follicles, or a one or more seeded berry. Seed containing copious horny albumen, with a minute embryo at base. The plants of this order are widely diffused over the globe, but more especially in temperate or cool climates. Within the tropics they are, with the exception of the genus *Clematis*, almost confined to high mountain-ranges. According to Lindley, there are 47 genera, including about 1,000 species. At least 13 of the genera are represented in the flora of Great Britain. An acrid principle is common to all the *Ranunculaceæ*, and a narcotic principle is sometimes present in addition. When these principles are in excess, the plants containing them are poisonous. Many of these plants are conspicuous ornaments of our fields and hedges. Many are cultivated in our gardens, as various species of *Clematis*, *Anemone*, *Ranunculus*, *Eranthis* (winter aconite), *Helleborus* (Christmas rose), *Aquilegia* (columbine), *Aconitum* (monkshood), *Pæonia* (pæony), &c. The *Moutan officinalis*, or tree pæony of China, is specially remarkable for its very large and numerous showy flowers. Fortune mentions one of these plants growing in the neighbourhood of Shanghai, which produced annually from 300 to 400 flowers. From the *Ranunculaceæ* the important drugs aconite, black hellebore, staves-acre seeds, and podophyllin, are derived. (*See* ACONITUM, RANUNCULUS, &c.)

RANUNCULUS, *ra-nun'-ku-lus.*—In Botany, the typical genus of the natural order *Ranunculaceæ*, composed of annual or perennial herbs, sometimes aquatic. The flowers are usually yellow or white. Sepals 5, very rarely reduced to 3. Petals 5, or sometimes more, each with a thickened hollow spot at the base, often covered by a minute scale (nectary). Stamens usually numerous. Carpels numerous, without awns, in a globular or oblong head, each containing a single ovule attached near its base. The indigenous species of this extensive genus are commonly known as buttercups. The showy *double ranunculus* of our gardens belongs to a Levant species: namely, *Ranunculus asiaticus.* Double-flowered varieties of several others, especially of our common yellow buttercups, are known to gardeners under the name of *batchelor's buttons.* *R. sceleratus* (the celery-leaved buttercup) and *R. Flammula* (the spearwort) are very acrid. *R. Ficaria* (the lesser celandine) has thickened roots, which contain a good deal of starch, and have, on this account, been used as food.

RAPACES, OR RAPTORÉS, *rap'-ay-sees.* (*See* ACCIPITRES.)

RAPE, RAPE-SEED.—In Botany, the *Brassica Napus.* (*See* BRASSICA.)

RAPHANIA, *rah-fay'-ni-a.*—A morbid disease, also called Ergotism, and described by Aitken as "produced by the slow and cumulative action of a specific poison peculiar to wheat and rye, and which gives rise to convulsions, gangrene of the extremities, and death." (*See* ERGOT.) The bad flour must be altered for sound and wholesome food, the blood purified by some reliable medicine, such as chlorate of potash, and the strength kept up by tonics.

RAPHANUS, *raf'-a-nus* (Gr., *raphanis*, a radish).—In Botany, the Radish, a genus of the natural order *Cruciferæ*. The Species *R. sativus* is the well-known salad root. Several varieties are in cultivation, some having spindle-shaped and others globular roots. The latter are commonly distinguished by the name of turnip radishes. Like most of the salad plants derived from the order *Cruciferæ*, radishes are antiscorbutic and pungent: owing to the excess of woody tissue, they are somewhat indigestible. To attain a large size they require a deep sandy soil.

RAPHIDES, *raf'-i-deez* (Gr., *raphis*, needle).—In Botany, the term now commonly applied to crystals of any form found in the cells of plants. In some plants they occur in such enormous quantities, that they exceed in weight the dried tissue in which they are deposited: this may be especially observed in some *Cactaceæ*. The root of Turkey or Russian rhubarb commonly contains from 35 to 40 per cent.; hence, when chewed, it appears very gritty; and as this kind of rhubarb commonly contains a larger proportion of raphides than any other, this grittiness has been employed as a distinguishing test. Cells containing raphides are very beautiful and interesting microscopic objects.

RAPPEE, *rap-pee'.*—The name of a kind of coarse grained snuff. (*See* SNUFF.)

RAPTORES. (*See* ACCIPITRES.)

RAREFACTION, *rair-e-fak'-shun* (Lat., *rarus*, rare; *facio*, I make).—In Natural Philosophy, the process of expanding or distending bodies. By means of rarefaction a body is made to possess more room, or to appear of larger bulk, without accession of any new matter. The rarefaction of the atmosphere is so enormous, that Newton considered that it was inconceivable on any other principle than an inherent repelling force in the air itself, in consequence of which its particles fly from each other mutually.

RASHES.—A class of skin affections, in which red patches or diffusions appear on the skin, disappearing when pressed, but returning and usually ending in the skin peeling off. Measles, scarlet fever, nettle rash, erysipelas, &c., are all characterized by rashes. (*See* those various headings, and also SKIN DISEASES.)

RASPBERRY. (*See* RUBUS.)

RASPBERRY VINEGAR.—A delicious beverage made by soaking plenty of raspberries for some days in good vinegar, and gently boiling the liquid for a few minutes with sugar.

RAT, *rat* (Sax., *ræt*; genus, *mus*).—A genus of rodent mammalia, numerous in species, and beyond all possibility of numbering them. Taken to the full extent which is included by Cuvier, the rat family comprehends no fewer than 14 or 15 genera, which have all some resemblances to each other, but most of them differing so much from the true rat in their dispositions and manners, that the same general description cannot be made to apply to them all. The true rats belong to a vegetable-eating family, and yet are all more or less fond of animal substances, and some of them attack living animals, without much regard to size; but when they do so, it is still in accordance with the general gnawing character of the Rodentia. They do not kill, but begin to eat the living body; and there are instances of rats having in this way inflicted terrible lacerations upon infants and helpless persons. At the same time, there is little doubt that rats destroy a vast number of offensive substances, and it is tolerably certain that in cities, where is an underdrainage by sewers, the brown rats, which make the sewers their principal haunts, contribute not a little both to cleanliness and health. The general characters which distinguish the genus from the other Rodentia may be stated thus:—The teeth consist of two incisors, two canines, and three cheek-teeth in each side of each jaw. The crowns of the cheek-teeth are tuberculated, and thus bruising teeth rather than grinding ones, and the incisors are firm, strong, hard in their enamel, sharp in their edges, and well adapted for gnawing. The ears of the genus are generally long, of an ovate or rounded form, and well-developed, and it is understood that the sense of hearing in all is very acute. The ears are nearly naked, as are also the feet, which are plantigrade. The fore feet have only four toes fully developed, the one answering to the thumb being merely a rudimental tubercle, though it is furnished with a little flat nail: the nails on the other four toes are well adapted for digging. The hind feet have all the five toes fully developed. The tail varies in length, but is generally long, naked, except a few short hairs, and is covered between them with a sort of scales, which are not true scales, however, but merely little hardened plates of the epidermis, which easily fall off, and are replaced by others. The principal fur is very soft; but it is generally interspersed with larger and thicker hairs, which are shining in their lustre. Many of them take the water readily, and preserve their fur dry; but there are some which are easily wetted. They are all very fond of drinking, which operation they perform by lapping with the tongue. In all the species the tendency to production is very great; and where they have food and shelter, and moderate warmth, it is not confined to any one season. The number of young in a litter is often considerable, exceeding that of the teats of the female, and in some cases double the number of these. The teats are six in number, and the young are often twelve. Foreign countries produce various species of the rat tribe unknown to Europe. There are two species of rat in Britain—the brown rat and the black rat.

The Brown Rat (*Mus Decumanus*) is but a recent importation into this country, or even into Europe, or the north of Asia, and nothing certain is known of its origin. It is asserted by some good authorities, however, that it is an Eastern animal, and that it first made its appearance in the western countries of Europe only during the earlier half of last century. They are properly ground animals, and in those places where the two species of this country are found together, they are called ground rats or flax rats, in distinction from the black ones, which are roof rats. The brown rat makes burrows with great vigour and expedition, if it cannot find any ready made, and loves to burrow under the foundations of walls and houses. It is partial to drains of foul water, swims with great facility, abounds in seaport towns, and frequently establishes itself on board of ship. They often undermine the foundations of granaries and storehouses, of manufactories which abound in offal, and of mills; and, in the last case, they sometimes mine through the dams of the ponds, and let out the water. In poultry-yards and preserved grounds they commit considerable depredations on the eggs and the young birds, and carry off considerable quantities of grain from ricks and barns. The brown rat is the largest of the genus to be met with in Britain, being ten inches long in the head and body, of which the head occupies two and a half. The ears are about two-thirds of an inch long, which is less than the length of those of the black rat. The tail is also shorter in proportion, and both they and the muzzle are nearly naked. The upper colour of the fur is grayish-brown, and the under colour whitish-gray. The body is thick and strong, and the expression of the animal is a mixture of cunning and sulkiness.

The Black Rat (*Mus Rattus*) is a smaller animal, of a darker colour, a more elongated head, and sharper muzzle than the preceding. It is equally omnivorous, but less productive. It is sometimes called the "old English rat," from the fact of its being known in England long before the appearance there of the brown rat. Its original country is extremely doubtful; ancient authors make no mention of it; and the prevailing belief is, that it made its way into Europe during the middle ages. Although it is still the prevailing species in many parts of Europe, it is now somewhat rare in Great Britain, and a belief has long prevailed that the brown rat has eaten up the black one; but there is no authentic evidence on the subject, and the fact that the localities chosen by the two species are different—the brown rat loving low-lying, cold, and damp places, whilst the black rat is a murine animal, and dwells in holes of walls and crevices of roofs—seems to lead to an opposite conclusion. The black rat is very considerably smaller than the brown one, seldom measuring so much as seven inches and a half in length; and though its muzzle is larger, its head is altogether shorter. Its ears are also larger and rounder, and its tail is longer than its body, while that of the other is not so long; the ears and tail are naked; the eyes rather large; the fur on the body shaggy; the whiskers and tufts of stiff hairs over the eyes very long; and the whole expression more rough and fierce than that of the brown rat. It is also more rapid in its motions and a better climber. The colour is black, with a tinge of gray above and ash-colour on the under-part; often whiter on the breast and throat.

The Malabar Rat (*Mus giganteus*), a species of enormous size; its length, including the tail, which is nearly a foot long, being thirty inches. It is found in many places on the Coromandel coast, in Mysore, and several parts of Bengal. The bite of this species is considered dangerous.

The Pilori or Musk-rat of the Antiles, is another large and destructive rat, measuring fifteen inches, exclusive of the tail. There are also the *Sumatra rat*, the *Caraco rat*, the *Alexandrian rat*, and the *Iceland rat*; the distinguishing characteristics of which are too slight to deserve particular notice.

The Water-rat is an animal respecting which naturalists are by no means agreed; for while some say that it is simply the common brown rat, others declare that it is a distinct species. The fact is that there is a distinct species of amphibious rat, but that the common brown rat often imitates its habits. The water-rat (*Mus major aquaticus*), or water-vole, as it is frequently called, is intermediate in size between the brown rat and the black one: the head is thick and short, and the muzzle is blunt, not indicating that keenness of scent which is possessed by the land-rat. The ears are less than half an inch in length, and almost entirely hidden in the fur, which is very closely set, and is of that shining character which, in the hairy animals, has a strong repulsion to water, so that it does not get matted, or even wet, when under water. The colour of the upper part is mixed brown, showing both a grayish and a reddish tinge; and the under part is gray, having in some individuals a yellowish tinge. The tail is not naked, like those of the land rats, but has fine short fur on the upper surface and pretty long hairs on the under. The fore feet have four complete toes, the last phalanx only of the thumb being conspicuous beyond the skin; hinder feet with five toes, not webbed, though connected for a short distance from the base. The water-rat is said to be one of those gentle Rodentia that would not, under any circumstances, hurt anything living. It inhabits the banks of rivers, streams, ponds, and even ditches, in the banks of which it burrows and breeds. The opening to its burrow is never very far above the level of the water, and if that level be subject to variations from floods, there are generally two openings, one higher and the other lower. As already observed, it is a vegetable feeder, and the fleshy and bulbous roots of plants form the chief part of its food. The water-rat is a very cleanly animal, and generally has but one brood, consisting of five or six; these are generally born in May or June, when the vegetation is well forward; but the young are sometimes produced as early as April, in which latter case there is a second litter towards the end of summer or beginning of autumn. When the animal is alarmed by any one treading on its burrow, or surprised on the grass at the entrance, it takes to the water as a means of safety, and gets down till it is quite submerged; but it has not the same power of continuing below as the otter and other mammalia which prey in the water It is found in all parts of Britain, and also of continental Europe. where the waters and their banks are suited to its habits, and is always most abundant where the banks are of a rich or loamy character.

RATAFIA, *rat-a-fee'-a.*—A word adapted from the French and applied generally to a series of beverages made by mixing some alcoholic liquor and simple sugar syrup with the juice of fruit, or of a flavouring substance. Usually almonds are used for this purpose, and hence the name is sometimes thought to mean almond-flavoured liquor or cakes alone. The name is said to be derived from the word *ratifying*, as small glasses of this choice liquor were drunk when *ratifying* a treaty, &c.

Ratifees, Ratifias, or Ratifia Cakes.—Small delicious cakes or biscuits flavoured with almonds.

RATEL, *rat'-ell* (*Mellivora*).—A genus of quadrupeds of which only two species are known—the Cape Ratel and the Indian Ratel. They are closely allied to the *Gluttons* (*see* GLUTTON), and belong to the Great Bear family *Ursidæ*. They are something like the badgers, but clumsier and heavier. The Cape Ratel, which inhabits the south of Africa, feeds much on bees and honey.

RATEL-A-COUM, *rah-tel'-ah-coom*, also called TURKISH DELIGHT and LUMPS of DELIGHT.—A Turkish sweetmeat made of starch and syrup, in the shape of cubes, from one to two inches square.

RAT-SNAKE.—A fangless snake, belonging to the family *Colubridæ*, easily tamed, and often kept in Ceylon for the purpose of killing rats.

RAT-TAIL MAGGOT.—A small grub nhabiting mud. It is the larva of the *Eristalis tenax*, family *Muscidæ*. It breathes by means of tubes like little telescopes, which are attached to the tail.

RATTAN, RATAN, OR ROTTANG.—A genus of canes (*Calamus*), or rather palms, having a slender-jointed stem, which sometimes, in some species, attains to an immense length, ascending, descending, and climbing among trees, to the extent of 1,000 feet. Others, again, are more erect. There are an immense number of species, but all are found in the East Indies, and all are useful for wicker work, &c. So strong are some species, that even bridges of great durability are constructed from them. They are imported in Britain under the general heading *Canes.* (*See* CALAMUS.)

RATTANY, RHATANY, OR RATAYNIA, *rat'-tan-ny.*—A plant found in Peru and Bolivia, the root of which is a powerful astringent and tonic. It is largely exported to Portugal, where it is used to give a rich red colour to wine. The botanical name is *Krameria triandra.*

RATTLESNAKE, *rat'-tl-snaik.*—A genus of American serpents (*Crotalus*), famous for the danger of their bite and the peculiar appendages to their tail, consisting of several horny membranous cells, of an undulated pyramidal figure, articulated one within the other, so that the point of the first cell reaches as far as the basis or protuberant ring of the third, and so on, which articulation being very loose, gives liberty to the parts of the cells that are enclosed within the outward rings to strike against the sides of them, and so produce the rattling noise which is heard when the snake shakes its tail, and from whence it derives its name. The head is broad, triangular, and generally flat in its entire extent; the eyes are very brilliant, and generally provided with a nictitating membrane; the mouth very large, the tongue forked at its extremity. The body is robust, elongated, cylindrical, covered above with carinated scales. The tail is short, cylindrical, and somewhat thick. The number of the little bells which terminate it increases with age, an additional one being formed with every casting of the skin. The noise made by them resembles that made by crumpled parchment, or by two quills of a goose rubbed against each other. Their fangs, which are two in number, one at each end of the upper jaw, are traversed by a canal for the emission of the poison, and when not used, remain concealed in a fold of the gum. The fangs are very sharp at the points, rather slender in proportion to their length, and awl-shaped, or adapted for inflicting punctured wounds only, and not for tearing or lacerating. The poison is secreted by a considerable gland, situated on each side of the head, immediately under the eye; and the same muscular action which forces the tooth into the body of the prey, compresses the reservoir of venom, and so forces it through the canal of the fang into the wound. The smell of these serpents is exceedingly offensive, even when they are alive, arising, it is supposed, from the rapidity with which the flesh of those animals on which they feed putrifies, from the action of the virus upon it. Their chief food is birds and squirrels; but they also devour rats, hares, and small reptiles. Their glance has been said to have the power of fascinating their prey, so as to make it drop into their mouths; but there can be little doubt that if this power exists, it has been greatly exaggerated. That a suddenly surprised animal should be arrested by terror, and easily fall a victim to the serpent, is highly probable; but that it should descend to its destruction from the top of the loftiest trees is almost incredible. The movements of the rattlesnake are slow, and it never appears to use its weapons unless when compelled thereto, either by necessity or fear. As they are no climbers, and their motions on the ground are so slow, and so much in a straight line that they would have little chance of capturing any prey by pursuing it, they usually rest twisted in a spiral form in the usual path of wild animals, particularly in those which lead to the water. They will not spring upon any large animal they are unable to swallow, unless they are reduced to extremities by impending hostilities; and most of those persons who have been bitten by them have thus suffered in consequence of treading unawares upon them, or making an unskilful attack. The remedies employed against the bite of the rattlesnake are suction, ligatures, caustics, and internal medicines. Till the month of July, their bite is comparatively harmless. All the species of *Crotali* whose country is well known are natives of the American continent; and some of them, though the winter is much colder than in the same parallel of Europe or Asia, are found much farther north than any serpent of nearly the same deadly venom is met with in the Eastern continent. Those which are found far to the north are torpid during the winter; whilst those in the tropical parts of the country are never torpid, though they remain in hiding-places during the rains. Rattlesnakes are viviparous, and live a long time, some having been found, it is said, with from forty to fifty pieces in their rattles, and from eight to ten feet in length. They traverse with ease rivers and lakes by swimming.

RAVEN, *rai'-ven* (Sax., *hræfn*; probably from Sax., *hreflan*, to plunder, to rob).—The generic characters of the raven (*Corvus Corax*) are —beak straight at the base, compressed at the sides, curved towards the point, and sharp at the edges; nostrils basal, open, hid by stiff feathers directed forwards; wings pointed, the first primary of moderate length, the second and third shorter than the fourth, which is longest; feet three toes before, one behind, almost entirely divided; tarsus longer than the middle toe. The great geographical range of the raven north of the equator causes it to be exceedingly well known, and it is as universally recognized in many other parts of the world as it is in this country. It is, in fact, a universal species, found both in the old and new continents—from Greenland to the Cape of Good Hope in the one, and from Hudson's Bay to Mexico in the other. It is one of the few birds that are capable of braving the severity of an Arctic winter and the scorching rays of a tropical sun, without any change being produced in its plumage by the extremes of climate. It is by far the largest specimen of the genus to which it belongs (*Corvidæ*), and being bold as well as sagacious, is always an object of suspicion to shepherds and husbandmen; for no sooner does an animal show any signs of weakness than the raven is on the watch for an opportunity to satisfy his appetite. If no interruption occurs, he makes his first attack upon the eye of the defenceless animal, afterwards feeds at his leisure, retires to digest his food, and then returns to feed again. Like the other birds of its genus, it is not particular as to its food, eating indiscriminately small animals, such as rabbits, birds or their eggs, reptiles, insects, grain, or carrion, and any dead fish or other animal substance which may be washed ashore by the tide. Its favourite abodes are high rocks on the seashore, extensive woods, mountains, or open plains. The female breeds early in the season, and by the beginning of February, the ravens may be seen visiting and repairing their nest of the previous year, which is usually placed in a very high tree, in the fork of a branch. It is formed on the outside of sticks, with a lining of wool and hair; the eggs are four or five in number, two inches in length, by one inch four lines in breadth, of a pale green ground-colour, spotted and speckled with darker greenish-brown. The incubation lasts twenty days, during which the male feeds the female as she sits upon the nest, and occasionally takes her place. When the young appear, they are for a time tended with great assiduity by their parents, but are driven away as soon as they are able to provide for themselves. Ravens live to a great age, and are considered to pair for life, and to occupy the same spot until driven away from it. Should both occupiers of any locality be killed, it is almost certain to be occupied by another pair. The raven measures fully two feet in length, and at least four feet in the stretch of the wings, and has the tail very firmly feathered, and equal in length to half the body. The plumage over the whole body is black, but glossed with blue re flections, which, in certain lights, give a very peculiar appearance. Cuvier and some authors mention, that in the extreme North it is frequently found more or less white; but other authorities, including the famous explorator Sir James Ross, strenuously deny this. In former times, ravens were by no means rare birds in Great Britain; and, indeed, there used to be an allegorical saying in most parts of the country, that "every rock has its raven;" but they are now comparatively rare in England and in the south of Scotland. Ravens make no defence against any attempt by men or boys to rob their nest, but against the attacks of other birds they display great power as well as courage, and, at close quarters, are said to be a match for the most powerful falcons. There are several interesting peculiarities about the raven, one of which is its thievish habit of carrying off shining metallic substances, and other articles, totally unfit for food or to be used in the construction of its nest; and another, its aptitude for imitating the human voice. The well-authenticated anecdotes in proof of its possession of this power are almost innumerable.

RAVENALA, or RAVINALA, *ra-ven'-a-la.*—In Botany, a genus of the natural order, *Musaceæ*. *R. speciosa*, a tropical plant, has been called the water-tree, in consequence of its petioles yielding, when cut, a quantity of watery juice. Its seeds are edible.

RAY, *ray* (Fr. *raie*, Sp. *raya*).—The rays (*Raiidæ*), or skate, are a very remarkable family of cartilaginous fishes, resembling in their physiology the shark family much more than any other, and following in their forms the angel-fish, or monk-fish, of that family. The generic characters are:—Form of the body rhomboidal, very much depressed; tail long and slender, generally armed on the upper surface with one or more rows of sharp spines; two small fins near the end of the tail, and sometimes a small terminal or caudal fin; the eyes and temporal orifices on the upper surface of the head, nostrils, mouth, and branchial apertures, beneath; teeth flattened, lozenge-shaped, the inner angle elongated in old males. The rays, or skate, as they are popularly called, are remarkable for the breadth of their bodies, contrasted with their long, narrow tails; the great breadth of the body being produced by the expansion of what are called the pectoral fins, the base of each of which is equal to the whole length of the side of the fish. The ray may almost be considered as having no true head or neck, the sides of both being included, and thus protected, by the expanded anterior margin of each pectoral fin. Their mode of progression is performed by a slight undulating motion of the pectoral fins, something between swimming and flying. They defend themselves, it is said, by bending the point of the nose and the base of the tail upwards towards each other; the upper surface of the body being then concave, the tail is lashed about in all directions over it, and the rows of sharp spines frequently inflict severe wounds. The rays are very voracious. Their food consists of any sort of fish they can catch, with mollusca, testaceous or naked, and crustacea. Their jaws and muscles are so powerful that they are able to crush the strong shell of a crab with ease. As in the sharks, the females are larger than the males. The young are produced during the latter part of spring or during summer, and are deposited by the parent fish in thin horny cases, which are also called purses, and which, on the coast of Cumberland, bear the name of skate-barrows, from their resemblance in shape to a four-handed machine by which two men carry goods. As the young ray increases in size, the angular parts of the body curve over for a time, till the fish ultimately escapes to provide for itself. The eleven species of true rays which are found on the coast of Great Britain may be arranged in two divisions: the first of which contains seven species, having the skin perfectly smooth; whilst the second division contains two species with rough skins, and two which are furnished with numerous short, sharp spines on various parts of the surface of the body. The ray, or skate, as food, is held in very different degrees of estimation in different places. In London large quantities are consumed, and the flesh is much esteemed; but on some parts of the coast it is seldom devoted to any purpose but as bait for catching crabs and lobsters. The ray is in best condition for the table during autumn and winter. In spring and the early part of summer they are usually maturing their eggs or young, and their flesh is then soft and woolly.

RAZOR-BILL, sometimes also called RAZOR-BILLED AUK, and the BLACK-BILLED AUK.—A species of Auk (*Alca torda*), common on the more rocky coasts of Britain and Atlantic shores of America. (*See* AUK.) The bird is about seventeen inches long, and lays but one egg, on a ledge of rock.

RAZOR-FISH, or RAZOR-SHELL. (*See* SOLEN.)

REACTION, in Medicine.—A recovery (usually gradual) from a state of relapse.)

Reaction, in Chemistry.—The mutual action of chemical agents upon each other. (*See* REAGENT.)

REAGENT, *ree-ay'-jent.*—The name given to a chemical test which distinguishes the presence of a substance, or group of substances, by the mutual action it and they exert on one another.

REALGAR, *ree-al'-gar.*—The name given to native sulphuret of arsenic, and consisting of about 30 parts of sulphur to 70 of arsenic. It usually occurs in needle-like crystals, prism shaped, though it is also found in a massive state. It is of a very brilliant scarlet colour, soft, so that it will yield to the pressure of the nail; it is sometimes transparent. It is found in the neighbourhood of volcanoes and in igneous rocks.

REAUMURIACEÆ, *ro-mure-e-ai'-se-e* (in honour of Reaumur, the celebrated French philosopher).—In Botany, the *Reaumuria* family, a small natural order of Thalamiflorous *Dicotyledones*, resembling *Hypericaceæ* in most essential characters, and only distinguished from that order by having a pair of appendages at the bases of the petals and shaggy seeds, with small mealy albumen. There are three genera and four species, natives of the Mediterranean coast and the salt plains of Northern Asia. They contain much saline matter. A decoction of the leaves of *Reaumuria vermiculata* is used as an internal medicine, and the bruised leaves as an external application for the cure of the itch.

RECENT, OR HUMAN, PERIOD.—In Geology, the name given to that period in the world's history since man has been on the earth. (*See* GEOLOGY.)

RECIPE, *res'-e-pe* (Lat., take).—Is a name sometimes applied to a medical prescription, from the symbol ℞, denoting recipe, with which it begins. According to some, this character is the astrological symbol for Jupiter, the planet whose ascendency was regarded as favourable for the collection and preparation of medical herbs.

RECTIFYING, *reck'-ti-fy-ing.*—This word means correcting, amending, or refining, and when applied to alcoholic liquors it means the process whereby certain impurities are removed from alcohol after its distillation. There is often a quantity of water, and also certain essential oils in the liquor; it is therefore treated first with caustic potash (gray salts) to saponify the oil, and common pearlash (white salt) is also added to aid in removing the water and oil. About 4 lbs. of each are mixed with every 700 gallons of the spirit, which is then distilled again, the pearlash being left in the still in combination with the oily matters, &c. This process is repeated two or three times, the quantity of salts being each time diminished to one-half the previous quantity used. Previous to the last rectification, the flavouring matters are put in—such as juniper berries and coriander seeds for gin, &c. (*See* DISTILLATION, and various headings of liquors.)

RECTUM, *rek'-tum* (Lat., straight).—In Anatomy, is the name given to the lowest portion of the large intestine, and was so called from an erroneous notion among the old anatomists that it was straight. It is about eight inches in length, and commences at the sigmoid flexure of the colon, terminating in the anus. It is cylindrical in shape, and not sacculated like the colon, and is narrow at its upper part, becoming gradually dilated towards its termination, just above which the dilatation is considerable.

Diseases of the Rectum.—This part of the body is liable to various diseases, some of which have been treated under their names. (*See* HÆMORRHOIDS, FISTULA, PROLAPSUS ANI, &c.) Other complaints are Abscess, Stricture of the Rectum, Fissure of the Anus, and Irritation.

Abscess.—Weakly young persons are sometimes subject to the formation of abscess in the areolar tissue, outside the rectum; and frequently the collection of matter is situated at a considerable depth. This is shown by the tenseness and pain at the verge, and there is considerable difficulty in passing motions, or urine. The abscess usually "point" at the margin of the anus, and should be opened at once in order to prevent the formation of fistula. The greatest attention must be paid to the improvement of the general health.

Fissure.—Fissures are small chops or cracks, which form in the mucous membrane, just inside the rectum, and are usually situated at the posterior part. Fissure is almost always associated with dyspepsia. The pain is most excruciating on passing a motion: medical aid should be sought at once. A slight operation, such as dividing the fissure with a bistoury, subsequent attention to diet and general health, are usually all that is required to effect a cure.

Stricture is a contraction of the walls of the rectum, and is usually caused by organic disease. The bowels should be kept open and a bougie carefully used as directed by a medical man.

Irritation of the Rectum, Pruritus.—Itching of the anus is a very common and troublesome complaint, and is usually connected with some irregular state of the mucous membrane lining the rectum, although there may be other causes. Tar pill is often successful, together with cold bathing, exercise, and avoidance of highly-seasoned foods, spirits, and coffee.

REDBREAST, *red'-brest.*—This bird (*Erythaca rubecula*), which is commonly called the robin, or robin redbreast, is generally diffused over England, Ireland, and Wales, and is also an inhabitant of the most northern counties of Scotland. It also visits Denmark and Sweden in the breeding season; and amongst the summer visitors to the latter country, it is said to be one of the first to arrive and last to go. It is a constant resident throughout the year in the temperate and warmer parts of Europe, abundant in Spain and Italy, from the last of which it passes over by Sicily and Malta to North Africa. In America, however, the name Redbreast is often applied to another bird, the *Blue Bird* (which *see*). In the adult bird, the beak and irid es are black; upper part of the head, neck, back, upper tail-coverts and tail-feathers, a yellowish olive-brown; quill-feathers rather darker, the outer edges olive-brown; greater wing-coverts tipped with buff; over the base of the beak, round the eye, the chin, throat, and upper part of the breast, reddish orange; encirling this red is a narrow band of bluish-gray, which is broadest near the shoulders; lower part of the breast and belly white; sides, flanks, and under tail-coverts, pale brown; under surface of wing and tail-feathers, dusky-gray; legs, toes, and claws, purple-brown. The whole length of this bird is nearly six inches. The length of the wing, from the carpal joint to the end of the longest quill-feather, three inches; the first quill-feather but half the length of the second, which is not quite so long as the sixth; the third, fourth, and fifth, nearly equal and the longest in the wing. The female is not quite so large as the male, and her colours are less bright. The redbreast is subject to variation in the colouring of the plumage. White, and partly white, varieties are not uncommon. During summer, it feeds indiscriminately on earthworms, insects, fruit, and berries. In winter, when pressed by hunger, it hovers round human habitations, both in town and country, and becomes a welcome pensioner. The redbreast, in common with some other birds, is remarkable for the peculiarity of the situation in which it sometimes builds its nest; one pair, for instance, having built theirs in a saw-pit, whilst it was in constant use. But stories of this sort are almost innumerable. The robin breeds early in spring; its nest is formed of moss, dead leaves, and dried grass, lined with hair, and sometimes a few feathers; the nest is frequently placed on a bank sheltered by brushwood, or a short distance above the ground in a thick bush or lane-hedge, sometimes in a hole in the wall, partly covered with ivy. The eggs are from five to seven in number, white, spotted with pale reddish-brown;

the length nine lines and a half, by seven lines and a half in breadth. The song of the robin is sweet and plaintive, but not powerful.

RED CHALK, OR RADDLE, OR REDDLE.—A sort of iron-ore mixed with red-coloured clay found in England in small quantities, but largely imported from certain parts of Germany. It usually occurs in thin beds, with clayey slate. There are various qualities, the finest being used for drawing on paper; commoner kinds are used by carpenters, &c., for marking; and the commonest kinds for marking sheep. Other kinds are used for polishing spectacle-glasses.

RED COLOURS (Sax., *red* or *read;* probably the origin of the word is to be found in an old Norse word, *rioda*, to make blood, or like blood).—Properly speaking, red colour means a colour like that of arterial blood. The red colours or pigments used by painters usually consist of natural or artificial chemical compounds, thus chrome-red is made by boiling chromate of potash in excess with carbonate of lead, then washing in pure water and drying; red ochre, again, is an oxide of iron, and is largely found in a natural state in the Mendip Hills. The principal red colours are Armenian Bole, Indian Red, Vermillion, Sandix, calcined white-lead, Light Red, &c., and will each be found described under their respective headings.

RED CRAG.—Certain sandy quartz, mingled with shells, belonging to the Pleiocene strata, and found in Suffolk; it is of a red colour, something like deep-coloured rusty iron.

RED DEER. (*See* DEER, STAG.)

RED-EYE, OR RUDD.—A fish much like the roach, but better for the table. It belongs to the family *Cyprinidæ*, and is found in sluggish waters in many parts of England and Europe. It is called Red-eye from the colour of the iris, and the name Rudd has been given to it because of the colour of its body. Its scientific name is *Leuciscus Erythropthalmus.* (*See* LEUCISCUS.)

RED GUM.—The common name of a florid eruption of the skin, known to the medical profession as *strophulus.* It usually attacks infants before or during the time of the first teething, and appears on the face, neck, hands, and arms, often spreading from these parts to portions of the body less exposed. It appears in small red pimples, with a few little vesicles interspersed, and occasional red patches. Sometimes white pimples appear, which are called White gum. The disease is not dangerous. Care must be taken that the child does not catch a chill, so that the irritation is driven inward to some internal organ; while, on the other hand, the little patient must not be too hot, otherwise the pimples may itch and irritate, and slight febrile symptoms may appear. The child must be kept scrupulously clean, but no cold water must be applied. If the complaint should be driven inward, a hot bath must be given, and mustard poultices or hot fomentations applied to chest and arms.

RED-HOT SHOT.—Cannon-shot heated to redness and fired from cannon at wooden buildings, powder magazines, and shipping, &c., so as to set them on fire. It is said that shells containing molten iron were fired by the Federals in the American civil war.

RED LEAD. (*See* MINIUM.)

RED POLE. (*See* LINNET.)

RED ROOT.—A genus (*ceanothus*) of plants of which there are several species belonging to the natural order *Rhamnaceæ.* They are deciduous shrubs with large red roots, hence their name, and having simple alternate leaves. The Common Red root of America is often called New Jersey Tea, because the dried leaves are often used for tea. An infusion of the leaves is useful for the sore throat of scarlet fever and also for dysentery. A cinnamon-coloured dye is also made from the plant.

RED SANDSTONE.—A term now quite disused, but formerly given to the combined Devonian and Permian Rocks. Since the discovery, however, that one set was below coal, while the other was above it, the Red Sandstone rocks have been divided into the Devonian or Old Red Sandstone and the Permian or New Red Sandstone. (*See* these headings, and also GEOLOGY.)

RED SHANK. (*See* SANDPIPER.)

RED SNOW, RED SNOW PLANT.—The phenomenon of red snow is sometimes seen in polar and Alpine regions, and from experiments made by Sausure, it is supposed to be due to the presence of some vegetable substances—he says, probably the pollen of a plant in the snow. The eminent botanist, Robert Brown, however, pronounces it to be due to the presence of a minute unicellular plant belonging to the order *Algæ.* Sir William Hooker is of this opinion, and has given the name *Palmella nivalis* to the plant. Agardh calls it *Protococcus nivalis.* (*See* PROTOCOCCUS.) There are other opinions, some of which maintain that these organisms are not miscroscopic plants, but animalculæ, while others think that there are both minute plants and animalculæ in the red snow. Captain Ross, in his Arctic expedition, observed a large tract of cliffs on the shore of Baffin's Bay, extending for about eight miles, all covered with red snow, the red colour penetrating the snow to the depth of about 12 feet. It is supposed that the ancients were acquainted with this phenomenon, and a passage in Aristotle apparently refers to it. Snow is often apparently red, when in mountain and winter landscapes the rays of the sun fall obliquely upon its surface; and this effect of light is peculiarly beautiful and charming.

REDSTART, *red-start.*—A summer bird of passage in Britain, nearly allied to the Redbreast, and belonging to the *Sylviadæ.* It is found in the north of Africa, and the warmer parts of Europe and Asia. In the male bird the top of the head, the back and wing coverts, are of a gray colour; the forehead white; the throat, sides of neck and face, jet black; the under parts pale chestnut. The female is grayish brown. Redstarts are quick, lively birds, with a soft melodious song.

The American Redstart, belongs to the Flycatcher family (*Muscicapidæ*).—It is a lively bird, quick and active in its movements, and very beautiful in its plumage. (*See* FLYCATCHERS.)

REDUCTION, *re-duck'-shon.*—In Arithmetic, the changing of a quantity in one denomination to an equivalent quantity in another denomination. (*See* ARITHMETIC.)

RED-WATER, also called **HÆMATURIA, MOOR-ILL, AND BLOODY URINE.**—A disease of cattle, and sometimes attacking sheep, in which the urine is reddened with the red matter from the blood. It is caused by the eating of bad food, and by exposure to bad weather, which leads to an impaired state of the blood and severe constipation. In severe cases the colour of the urine becomes black. The animal should be physicked so that the bowels may be relieved, and the food should consist of good hay and a little cake; a plentiful supply of pure water should also be given. Gentian and ginger are recommended to strengthen the system.

REDWING *red'-wing.*—A British winter bird of passage (*Turdus iliacus*), in size and shape something like the song-thrush, being, in fact, a species of thrush. It passes the summer in northern latitudes, and in the winter flies as far south as even the Mediterranean. The predominant colour is a rich clove; the lower parts are streaked with brown, and the under wing-coverts are a bright red-orange. It has a beautiful song, and congregates in large flocks like the Fieldfare. (*See* FIELDFARE and THRUSH.)

REDWOOD, *red'-wood.*—The name of a large tree (*Adenanthera pavonina*) growing in India, and much used there for dyeing red.

REED. (*See* ARUNDO.)

REED MACE. (*See* TYPHA.)

REED WARBLER. (*See* WARBLER.)

REEF. (*See* CORAL REEF.)

REFLECTION, *re-flex'-shon* (Lat., *reflecto*, to bend back, or turn round).—The turning back again of light or sound after striking upon any surface. Mainly by the labours of Brewster, the *colour* of reflected light has been found to differ from that of direct light, and it is also different for different angles of reflection. (*See* HEAT, LIGHT, CATOPTRICS, UNDULATORY THEORY OF LIGHT, &c.)

REFLEX ACTION. (*See* NERVOUS SYSTEM.)

REFRACTION, *re-frak'-shun* (Lat., *re*, and *frango*, I break).—In Optics, the turning of a ray of heat, light, or other imponderable substance, from its direction when it falls obliquely on the surface of a medium differing in density from that through which it had previously passed. (*See* HEAT, LIGHT.)

Refraction of the Stars.—In Astronomy, signifies an inflection of the rays of those luminaries in passing through our atmosphere, by which the apparent altitudes of the heavenly bodies are increased. Atmospheric refraction of the rays of the sun after sunset, combined with subsequent reflection, is the cause of twilight, and also of the light thrown on the moon's surface when eclipsed by the earth.

Refraction of Light. (*See* LIGHT.)

REFRAIN, *re-fr'ane.*—The words of a song which are repeated at the end of every stanza; sometimes these words are called the *burden* of a song.

REFRIGERANTS, *re-fridg'-er-ants.*—The name given to a class of medicines, which have a cooling influence on the body. There are two kinds of these Medicines, first, those for internal, and second, those for external use. The former cause a sensation of coolness and refreshment in the body, though they do not really lower its temperature; they appear to produce these results by acting directly on the coats of the stomach, which by nervous sympathy occasions a temporary lowering of the force of the circulation, some also act by allaying irritability of the stomach, reducing morbid thirst and heat, &c. The principal refrigerants of this class are saline draughts of various kinds, such as seidlitz powders, &c., lemonade, the chlorate and nitrate of potash, taken in thin syrup or milk, and recommended by some physicians, oxalic acid. Being poisonous, the latter should be used with great care. The second kind of refrigerants—those for external use—are of great value in the treatment of wounds and in cases of severe inflammation, their great object being to reduce the local temperature, though not too much so as to cause gangrene. In many cases this is accomplished by spreading cloths wetted with cold water over the affected parts, keeping them at their original temperature by re-wetting or changing, care being taken to expose their surface freely to the air, so that there may be ample evaporation. In severe cases of brain disease, or of fever complicated with brain disease, or of strangulated hernia, &c., pounded ice placed in bladders, or in thin india-rubber bags, is preferable to wetted cloths. Sometimes the bags are filled with freezing-mixture, and in certain severe cases, moulds have been made to fit the affected part, and kept on continuously for weeks. It is said that an inflamed or wounded knee-joint may be effectually treated by the application of cold alone, together with rest of the parts. But in all cases, both as regards the degree of cold and the time or continuousness of its application, the advice of the doctor should be consulted, and he will be guided to a very large extent by the feelings of the patient, the general rule being that if the application give discomfort it is doing harm, but if the reverse it is almost certain to be doing good.

REFRIGERATION OF THE EARTH.—The name given to the belief that the earth is gradually growing colder. As the temperature of the earth increases, the deeper we descend below its surface, so that in very deep mines the heat has been described as stifling, it is believed that the outside of the earth loses heat, because in any conducting body the passage of heat is always from the hotter to the colder parts. If the conducting power of the outside be known, and also the rate at which the temperature increases, the quantity of heat lost may be calculated. These data differ very much, however, in different localities, and consequently the following average has been struck—viz., for every fifty feet of descent, the temperature increases 1 deg. Fahr. Several hypotheses have been formed to account for the increase of temperature of the earth towards its centre, but we have no space here to consider them, only to indicate the one which is generally believed to be correct—viz., that, originally, or at least millions of years ago, the earth was in a molten state, such a state being due to its formation by the rushing together of cosmical masses by the force of gravitation. This spherical mass of molten matter gradually lost its heat, and became refrigerated or colder externally, the low rate of conductivity preventing the interior heat from making the surface the same enormous heat as it is itself. This process is believed to be still going on, but so low is the conducting power of the earth for heat that scarcely 1 deg. Fahr. of its heat on the surface is obtained from the intensely heated molten mass within.

REFRIGERATOR, *ree-fridg'-er-ay-tor.*—(*See* FREEZING, FREEZING APPARATUS, FREEZING MIXTURES.)

REGELATION, *re-jel-ai'-shun*, (Lat., *regelo*; from *re*, and *gelo*, I freeze).—It was noticed by Professor Faraday, a few years ago, that when two pieces of ice with moistened surfaces were placed in contact, they froze together; if, however, the surfaces were dry, they did not cohere. The phenomenon of the freezing of the moistened surfaces has been designated *regelation*. It is owing to this circumstance that, during a thaw, the particles of snow cohere into a solid lump, whilst during a frost, it is difficult to form the dry particles into a compact mass. Regelation will take place between the surfaces of blocks, even when the temperature of the surrounding atmosphere is as high as 80° or 90°. Certain solids, such as flannel, hair, or cotton, will freeze to ice even in a warm atmosphere; though others, such as saline substances, gold-leaf, and the metals generally, will not freeze to it. Professor Tyndall accounts for regelation, upon the theory that heat is the result of vibratory motion; the liquefaction, therefore, of ice when perfectly homogeneous, must necessarily take place more easily upon the surface than within the mass. Conversely, the freezing of a thin layer of water between two masses of ice should occur more readily than upon the surface of a single mass. This explanation is insufficient; for if true for ice, it ought to be true for all substances solidifying after fusion, when two portions of the solid are brought in contact beneath the still liquid mass. Besides, it offers no explanation of the freezing of ice to flannel, which certainly appears to arise from the same cause as the freezing of ice to ice. Other theories have been started to account for regelation, none of which are satisfactory; the phenomenon, therefore, at the present time requires further elucidation.

REGISTER OF VOICE.—The various kinds of sounds in the scale of notes produced by any individual voice, thus the sounds of the falsetto, or "head" voice, are spoken of as the *upper register;* those sounds produced by the "chest" voice are the *lower register*, and those sounds between the two are the *middle register*. (*See* VOICE.)

REGULAR BODIES. (*See* BODIES, REGULAR, a sub-heading under BODY.)

REGULAR FIGURES, *reg'-u-lar* (Lat., *regularis*).—In Geometry, are those whose sides and angles are equal; as a square, a cube, or an equilateral triangle.

REGULUS, *reg'-u-lus.* (*See* GOLDEN-CRESTED WREN.)

REGULUS, *reg'-u-lus.*—In Metallurgy, a term meaning "little king," and originally given by the old alchemists to the metal antimony because of its power to make gold brittle. It is now used, however, to denote any metal in a greater or less extent of impurity, thus when ore is smelted, the product of the various furnaces through which it is passed is called "regulus" until the metal is made pure or nearly so.

REGUR, *ree'-gur.*—The Indian name for the cotton soil. It is a rich dark coloured loam, and extends over level tracts of country for a considerable distance. In depth it varies from 3 to 20 feet.

REINDEER, *rain'-deer* (Sax., *hrana*, Dut., *rendeir*, Ger., *rennthier*).—This animal (*Varaudus rangifer*) has a multitude of synonyms, and by English writers is called, indiscriminately, the reindeer, caribou, and Greenland buck. It is a native of the Arctic circle in Europe, Asia, and America. It is about the size of our stag, and has the horns elongate, subcylindrical, and with the basal branches and tip dilated and palmated. It varies exceedingly in size; some of the specimens in the British Museum being 41 inches, and others 50 inches high, at the withers. There are several varieties. In the fur countries there are two varieties, one confined to the woody and more southern districts, and the other retiring to the woods only in winter, and passing the summer on the coast of the Arctic seas. A large variety occurs in Siberia, which the Tungusians use for draught. In Newfoundland, also, there is a large variety, nearly as large as a heifer, which has very large and heavy horns. In the north of Europe the reindeer is domesticated, and its services are invaluable. Possessing the reindeer, the Laplander can dispense with the services of horses, sheep, and oxen; for it will carry him in his sledge over the snow thirty, forty, or fifty miles a day. Its milk provides him with cheese; its flesh supplies him with food; and its skin furnishes him, not only with clothing, but with tents and bedding. In winter, the hair of the reindeer is long, thick, gray-brown; neck, rump, belly, ring round the hoof, and end of nose, white. In summer, the same animal has short, dark, sooty-brown hair, with the parts which are white in winter, being rather paler gray-brown. The hair of the body is so thick that the skin cannot be seen when it is put aside; for it stands erect, as in other animals of the same genus, but is much thicker. The size of the reindeer, as already stated, varies considerably, and increases in proportion to its proximity to the pole; the reindeer of Norway and Sweden being small when compared to those of Finmark and Lapland, which, in their turn, yield to those of Spitzbergen, while these again fall short of the more polar races. The reindeer when wild travel in herds, varying in number from eight or ten to two or three hundred, their daily excursions being generally towards the quarter from which the wind blows. The Indians kill them with bows and arrows. They also take the reindeer in snares, or spear them as they are crossing rivers or lakes. The Esquimaux take them in traps ingeniously formed of ice and snow. The reindeer has been known to travel at the rate of nineteen English miles an hour, and on one occasion, one travelled 800 English miles in 48 hours.

REINDEER MOSS. (*See* CLADONIA.)

REINSCH'S TEST FOR ARSENIC, *rinesh's.*—This important test consists in acidulating the suspected solution with hydrochloric acid, and throwing into it some pieces of bright copper foil or gauze, and boiling for half an hour. If arsenic is present, it will be deposited on the copper, from which it is sublimed by heating the metal in a glass tube, octahedral crystals of arsenious acid being found on the cool portion of the tube.

RELAPSING FEVER, OR FAMINE FEVER, *re-lap'-sing.*—This complaint received its name from Dr. Jenner in 1850. Before this date, it had been vaguely known under various other names, such as mild yellow fever, five-day fever, seven-day fever, short fever, &c. It usually commences with a feeling of chilliness, frontal headache, and rigours; the tongue is covered with a thick whitish fur, and the skin is often very yellow; severe vomiting frequently occurs, and on the fifth or sixth day the patient is often delirious. On the seventh day a sudden change for the better usually occurs. A profuse perspiration breaks out, followed by a rapid lowering of the pulse, and the patient appears to have almost recovered. But after a few days a sudden relapse occurs, and all the previous symptoms of the fever return. After running a rather shorter course than before, these end again in a perspiration and a second convalescence, which may be and often is permanent, but sometimes is followed by further relapses. It should be understood that this fever is quite different from either typhoid or typhus, and its poison seems to be of a specific kind. The treatment should be simple and prompt. The bowels should be kept open, and perhaps saline aperients are the best for this purpose, while the vomiting may be checked by effervescing draughts. Some doctors would recommend calomel and rhubarb at first as aperients, afterwards calomel and opium combined in pills to combat the sickness. Wet sheet-packs to increase the perspiration are also beneficial, and copious injections of tepid water to wash the bowels are preferred by some persons to the more drastic aperients.

REMITTENT FEVER, *re-mit'-tant,* also known as *jungle fever, bilious fever, endemic fever,* and *marsh remittent fever.*—The gravest form of fever caused by malarious or miasmatic influences (*see* MALARIA), and is characterized by irregular repeated exacerbations, the remission being less distinct in proportion to the intensity of the fever. There is also functional disturbance of the liver and often yellowness of skin. There is a slight cold stage, which does not recur with every exacerbation; an intense hot stage, with violent headache and gastric irritation; and often, though not always, a slight sweating stage. It is most prevalent and fatal where high temperature and malaria act together, and is common in the delta of the Ganges. Bleeding must never be used, and mercury should never be given. Quinine is the great remedy, and 15 to 20 grains should be given on the first sign of remission, and this though the tongue be foul and the headache continue. The bowels must be freely opened either by purgatives or by enemas. Another large dose of quinine should be given at the second remission, and so on until cinchonism is produced. Hot fomentations will relieve the pain at the pit of the stomach. During convalescence, quinine and other tonics should be given, and when well enough, the patient should seek change of climate.

REMORA, OR SUCKING-FISH, *re'-mor-a.*—A fish (*Echeneis*) of which there are about ten known species, and of which the principal characteristic is an elongated disc or sucker covering the head and extending back beyond it, and which enables them to fasten themselves to various kinds of objects. Cuvier placed these fish among the *Discoboli* (which *see*), but they have since been constituted a separate family, the *Echeneidæ.* They have an elongated body covered with very small scales; a flat head and large mouth, with a number of small recurved teeth on both jaws, and one dorsal fin, soft-rayed placed above. The Common Remora is found in the Mediterranean, also in the Atlantic, and sometimes as far north as Britain. It is a small fish of a dusky brown colour, and seldom more than 8 inches in length, but others in the tropical seas are much longer. It is said that some of them are used for catching turtle. A ring, to which is fastened a cord, is placed round the tail of the remora, the fishermen then row out to the turtle, taking the remora with them in a vessel of sea-water. When sufficiently near, the sucking-fish is thrown towards the turtle, to which it affixes itself, when the cord is drawn in bringing back both the fish and the turtle. The sucker-disc is of great power, and enables the remora to attach itself with extraordinary tenacity to any object. It has been found attached to other fish, and frequently also to the bottom of a ship.

RENNET, *ren'-net* (from Anglo-Saxon, *rennan,* to run).—The inner membrane of the true stomach of the sucking calf. It is used for curdling milk—*i.e.,* to make it coagulate or *run* together, as in making junket, &c. As soon as the calf is killed, the stomach is removed, and the outer skin and all superfluous fatty matter are scraped away. The inner membrane is then salted for a few hours, and stretched out to dry, and when perfectly dry it will keep for a considerable time. To use it, a small piece is cut off and soaked in whey or a cupful of hot water for four hours. This liquid is then added to the milk, which it curdles, the less rennet used in proportion, making the more delicate curd. The acid gastric juice which the skin contains gives it the property of curdling milk. Sometimes the rennet is prepared from the inner skin of the stomach of the pig, fowl, turkey, and hare.

RENNET, OR RENNETT, APPLE (probably from the French *Reinette,* little queen).—The common name of a class of apple which includes some of the most beautiful varieties. As the trees grow regularly, they are suitable for dwarf standards. The skin of the rennet is usually of a rusty tinge; the shape is very regular and nearly globular; the taste sweet and also pleasantly acid. The inside is of a fine granular consistency, and the outside has a softness and unctuousness to the touch.

REPEATING CIRCLE, *re-peat'-ing* (Fr., *répéter,* to iterate).—One of the most complicated and ingenious of modern astronomical instruments. It was invented by the Chevalier de Borda in 1787, and obtained an immense reputation through having been the only instrument employed in the geodesical and astronomical observations of the great measurement of an arc of the meridian, on which the modern French system of measures, weights, and money, is founded. The prime objects of the repeating circle are to diminish the effect of errors of graduation, and to obtain very correct measurements by means of comparatively small instruments. The principle of repetition consists in moving the telescope successively over portions of the graduated limb, corresponding to the angle to be measured, and reading only the multiple arc. Borda's repeating circle consists of a graduated circle, supported on a tripod that allows of its being placed in all possible directions, and furnished with two telescopes, having reticules at their foci. The whole circle turns round on a vertical column, which has an inner axis of steel, with good fittings at the top and bottom. The top of the column finishes in a square bar, to which the upper works and circle are firmly screwed. The chief objections to Borda's instrument are that it is heavy and rickety, and not sufficiently portable; but it possesses two valuable properties: mere errors of division may be diminished by sufficient patience, and the fatigue of reading off the divisions, the most ungrateful part of an observer's task, is greatly reduced.

REPRODUCTION, *re-pro-duk'-shun* (Lat., *reproduco*, I reproduce).—This term is sometimes used in Physiology to signify generation; it is, however, more especially employed to denote those processes in organic beings by which the individual being is produced, developed and maintained. In this way it has been employed to denote several processes which are functionally distinct or have very different ends in the economy of nature. The result of the ordinary processes of nutrition is the constant reproduction of the same tissue in the same parts, and is, therefore, the means by which the form of a being is maintained during life. Through the whole of the animal and vegetable kingdoms, this function is carried on until the death of the whole or part of the being. However, this power of reproducing the same tissues varies in different beings; and while a lost limb can be restored to the lower animals, no such power belongs to the more highly-organized animals or plants. The origination of the germ from which individual animals and plants grow is sometimes called reproduction. In this way, the production of cells, by which the life of the individual is maintained, is called *reproduction;* while the arrangement by which its existence as an individual is insured is called *generation*. In the ordinary reproduction of the tissues of animals and plants, each cell has the power of producing other cells, or a large number of the same kind of cells are produced simultaneously; in generation, on the contrary, it is necessary that two cells should take part. The two cells thus engaged have been termed the *germ*-cell and the *sperm*-cell. The former is that in which the process of growth of the new being commences, whilst the latter is that which communicates the growing tendency to the former. In the animal and vegetable kingdoms, these cells are of different sizes and forms, and placed in various positions relative to other organs; the means also by which they are brought together vary; but they perform the same fundamental functions in all cases. The most profound mystery in the generation of animals and plants is the reason why the same apparent combination of elements should assume a particular form. Between the cells of the flowers of the oak and the apple no difference can be discerned; nevertheless, one always produces oak-trees and the other apple-trees. In animal life it is the same: there is no appreciable external difference in the cells; but one set will produce one species of animal form and another set another species. This fact has led some physiologists to assume the existence of a *vital principle;* that is, of a distinct and independent essence, giving to each species its definite form and character. Three conditions must be regarded in studying the phenomena of reproduction and generation. First, the *formative force*, which is peculiar in every species, and similar in all the generative cells produced in that species. Secondly, the *physical conditions*, in which the generative cells are placed: these are more especially heat and light, and the condition of the membranes of the cell through which absorption goes on. Thirdly, the *elements* which are supplied for the nourishment of the new being, and which, by their chemical properties, are capable of exercising an influence on the form and development of the animal or plant. (*See* PHYSIOLOGY.)

REPTILES, *rep'-tiles*.—A class of animals (*Reptilia*), belonging to the sub-kingdom *Vertebrata*, and embracing the creatures usually known as crocodiles, lizards, turtles, tortoises, and serpents, and placed, in zoological arrangement, between birds and fishes. The species are not so numerous as those of mammalia and birds, and the numbers found in cold and temperate climates are few in comparison to those existing in hot climates. The word *reptile* is derived from a Greek word signifying to crawl or creep; but this is not very descriptive of the whole of the order, neither is it expressive of a kind of motion that is peculiar to those animals which the order includes. Among reptiles, too, there is to be found every kind of motion which is found among any of the other three orders of vertebrated animals; but it is not performed by means of organs exactly similar, or in exactly the same style. Thus, for instance, many reptiles walk, run, or leap, but their limbs are not articulated like those of the mammalia. Some reptiles are capable of performing a sort of flight; but they do it by means of membranes, and not of any organs resembling wings, properly so called. Again, those that swim—and many of them are excellent swimmers—do not perform the motion by anything resembling fins, but by the flexure of the body or the action of the limbs. Reptiles are distinguished from the other classes of vertebrated animals by their having neither hairs on their body nor teats, like the mammalia; by their body being never covered with feathers, like birds; whilst their possessing feet and a tail, in form resembling those of quadrupeds, separate them from fishes. They are air-breathing animals, and cold-blooded. The skin is clothed with horny imbedded plates, or imbricated scales, which are covered with a thin and often deciduous epidermis. Their lungs are cellular, and the heart is trilocular. With only one or two exceptions, they are oviparous, and the young undergo no transformation after birth. Reptiles, by the latest systematic zoologists, have been divided into four living orders and five extinct orders. The four living orders are: 1. *Chelonia*, the tortoises and turtles; 2. *Crocodilia*, sometimes called *Loricata*, the crocodiles; 3. *Ophidia*, the snakes; and 4. *Lacertilia*, sometimes called *Sauria*, lizards. Formerly these were grouped into two classes, thus—1. those, the bodies of which are covered with overlapping scales, such as the lizards and serpents—*Squamata*, sometimes also called *Saurians* (this word is sometimes applied to the larger reptiles, generally including lizards, crocodiles, iguanas, chameleons); and 2. those, the bodies of which are covered with square imbedded plates, as the tortoises and crocodiles, &c.—*Cataphracta*, the shielded reptiles. Before this, the frogs and toads, &c., which have the skin naked and covered with mucus, formed a third sub-class, under the name of *Batrachia*; but they are now considered to form a separate class, under the name *Amphibia*. The five orders into which the extinct reptiles are divided, are: 1. *Pterosauria*; 2. *Ichthopterygia*; 3. *Sauropterygia*; 4. *Dicynodontia*; 5. *Deinosauria*. Reptiles are very tenacious of life, and in many of them a limb, or a part of a limb, will sprout again and grow, and come to be useful after it has been completely taken away; being in this particular completely unlike the other vertebrata, and assimilating to some of the animals that have no skeletons, and nothing that can be called a centre of organization—to the crustacea, for instance. The bones of the small reptiles are of the same structure throughout, without any cells for containing marrow; but in the larger *sauria* there are such cells, though comparatively few in number. The cranium, or bony protection of the brain, is very small in all reptiles, although the vast projection of the jaws in some species makes the head appear large. The vertebral column varies much in reptiles, in some of them there being hardly any distinction of articulated parts, whilst in others there are some of the most varied and perfect motions in the whole mechanical structure of animals. Though the muscles of reptiles have great irritability, and this continues long after death, it does not appear that they have much sensibility, properly so called, or that their motions and the effects of external impressions upon them are productive of as much pleasure or pain as those of birds. They have some of the organs of local sense well developed, and others very imperfect. Sight appears to be their most perfect local sense; the eyes of most being well formed and ready in use. As to hearing, on the other hand, there are few or none of them that have external ears except the crocodile, and although never entirely wanting, the internal parts of the ear in all of them are somewhat imperfect. The organs of tasting and smelling are also not of the most perfect kind.

REPULSION, *re-pul'-shun*.—The act of repelling or forcing back; the theory that just as certain bodies or their particles attract each other, so certain others repel one another. This theory is now discredited by some scientific men, though it is not clear, for instance, how the repulsion in electricity (*see* ELECTRICITY) and magnetism (*see* MAGNETISM) is to be accounted for. (*See* FORCE, ATTRACTION, &c.)

RESECTION, OR EXCISION OF JOINTS, *ree-sek'-shun*.—Surgical operations in which the bone of a joint is cut out instead of amputating the whole limb. By many doctors this operation is deemed safer than that of amputation.

RESEDA, *re'-se-da* (Lat., *resedo*, I assuage).—In Botany, the typical genus of the natural order *Resedaceæ*. *R. odorata* is the mignonette plant, which is so much cultivated in gardens and window-boxes for the delicious fragrance of its inconspicuous flowers. *R. luteola*, usually known under the name of *weld*, is a common plant in Britain: it yields a yellow dye.

RESEDACEÆ, *re-se-dai'-se-e*.—In Botany, the Mignonette family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*, having the following essential characters: Herbs (usually) with alternate leaves and unsymmetrical flowers. Disc large, hypogynous, one-sided. Stamens definite, not tetradynamous. Ovary sessile, 1-celled; placentas 3—6, parietal; stigmas 3, sessile. Fruit usually opening at its apex long before the seeds are ripe. Seeds usually numerous, reniform, exalbuminous. There are six genera, including about 40 species, chiefly natives of Europe and the adjoining parts of Africa and Asia. (*See* RESEDA).

RESIN, *res'-in* (Fr., *résine*).—In Chemistry, when common turpentine is distilled with water, a residue of resin, or rosin, is left, amounting from 70 to 90 per cent. of the turpentine used. There are two kinds of resin in the market—the brown, which is obtained from the *Pinus Abies*, and the white, or gallipot, which is furnished by the *Pinus maritima*. The former consists almost entirely of pinic and sylvic acids, and the latter of pionaric acid. Resin is used in the manufacture of yellow soap, in which it is present in the form of pinate and sylvate of potash. It is considered by many to be an adulteration; but it seems to increase the lathering quality of the soap.

RESINS.—An important class of vegetable substances, extensively used in manufactures, obtained from various trees by making incisions in their bark, from which they exude in the form of a viscid liquid, consisting of the essential oil of the plant holding the resin in solution. They are mostly formed by the exudation of the essential oils contained in the trees. They are mostly insoluble in water, but dissolve readily in alcohol, forming varnishes. They mostly consist of one or more acid resins, which form, with potash and the other alkalies, solutions similar to soaps. Physically they are transparent, or translucent, brittle solids. They are insulators of electricity, and become electrical by friction. They fuse at a moderate temperature, are very inflammable, but burn with a dense smoky flame. Heated in close vessels, they undergo decomposition, and furnish various forms of hydrocarbon. The resins most extensively employed in the formation of varnishes are copal, mastic, sandarach, lac, elemi, anime, and some few others. The principal solvents employed are oil of turpentine, wood, naphtha, methylated spirits, and spirits of wine. When varnish is spread over any surface, the spirit evaporates, leaving the resin behind as a hard transparent layer.

RESOLUTION OF FORCES. (*See* FORCES.)

RESPIRATION, *res-pe-rai'-shun* (Lat., *re*, and *spiro*, I breathe).—In Physiology, is the alternate inspiration and expiration of atmospheric air. The blood which circulates through the system requires, for its purification and the restoration of its vital qualities, to be brought into contact with the atmospheric air, and this is effected in the lungs. The air brought into contact with the blood is decomposed, its oxygen uniting with the blood, while its nitrogen is returned by expiration unchanged, with an additional quantity of carbonic acid gas. The mechanical part of the function of respiration is effected by the action of the ribs and diaphragm. About twenty respirations take place in a minute, and from thirty to forty cubic inches of air are inhaled at each inspiration. (*See* LUNGS.)

Respiration, Artificial.—In all cases of suspended respiration, such as from drowning, noxious gases, &c., artificial respiration should be promptly attempted. The following method is from Dr. Sylvester's rules: The patient should be laid on his back, the head and shoulders slightly raised by a cushion placed under the latter. The arms should then be grasped above the elbow and raised until they meet just above the head. *This* imitates inspiration. They are then turned down and firmly pressed for a moment against the side of the chest, this movement imitating expiration. These two movements should be continued about fifteen times a minute.

Respirator.—An instrument invented by Mr. Jeffreys for placing over the mouth and warming the air before it is drawn into the lungs. This it does by having a number of layers of fine wire which absorb the warmth from the air breathed out, and give it to the air drawn in. Mr. Jeffreys says that the instrument should have about twenty layers of light wire-work.

Respiratory Sounds, *res-pi'-ray-to-ry.*—Are sounds produced by the inspiration and respiration of breath, and also those—including coughing—of the voice. On applying the ear to the chest, either directly or by the stethoscope, two distinct sounds may be heard—the one called the *vesicular sound* and the other the *bronchial sound*. The former has received this name because it is believed to be caused by the air passing from the ultimate tubes to the *vesicles* or air-cells; it is also known as the *respiratory murmur*, because its sound is something like the murmuring of a gentle breeze among trees. It is principally produced during *inspiration*, being scarcely perceptible during expiration. This sound is more distinct in women, and also in children, than in men; it is also more easily heard in thin than in stout persons. The *bronchial sound* is quite distinct from the *vesicular sound*. It is caused by the air moving through the bronchial tubes, and has a blowing sort of sound like blowing air quickly through a tube. These are the two sounds in healthy lungs, but when they become in any way morbid or diseased, these sounds become altered, and various other sounds are formed. When the respiratory function of any part of the lungs is impaired, the *vesicular sound* will be weak there, but louder than it should be in the other part. The bronchial sound, moreover, will be heard in parts of the chest where it is usually unheard, sometimes, indeed, being heard all over the chest. Other sounds are generally spoken of as *Râles* by French writers, and *Rattles, Rattlings, Sibilus*, by English writers who do not accept this term. *Râles* may be moist or dry, the former being caused by the passage of air through a more or less tenacious fluid in the bronchial tubes, by which a number of bubbles are formed, the bursting of which occasions the sound. The dry *râles* are caused by the air passing with increased rapidity through portions of these tubes, which have become narrowed. Dr. Ruddock speaks of *Râles* as a cooing, whistling, or mucous rattle in the chest. Other morbid sounds of the respiratory system are *metallic tinkling*, caused by a cavity containing air, and a *friction* or *rubbing sound*, symptomatic of pleurisy, caused by the rubbing of the sticky lymphy thrown out by the inflamed pleura and the roughened surfaces moving against each other.

REST-HARROW, *rest-har'-row.*—A weed (*Ononis*), the roots of which are very tough, and arrest the harrow as it passes—hence the name. The Common Rest-harrow (*Ononis Arvensis*) is a half-shrubby plant, viscid, with spiny stems and an unpleasant smell; it is abundant in the fields and waysides of Britain, the lower leaves having three leaflets and the upper being simple. Though a troublesome weed, it disappears before careful cultivation. There are other species, chiefly natives of Europe and nearly all half-shrubby or herbaceous; they belong to the natural order *Leguminosæ*, sub-order *Papilionaceæ*, having a five cleft bell-shaped calyx, the corolla large and striated, and the pod turgid and few-seeded.

RESTIACEÆ, *res-te-ai'-se-e* (Lat., *restis*, cord).—In Botany, the *Restio* family, a natural order of *Monocotyledones*, sub-class *Petaloideæ*. Herbs or under-shrubs. Leaves absent or narrow. Stems either naked, or more commonly with slit equitant leaf-sheaths. Flowers with glumaceous bracts, spiked or aggregated, generally unisexual. No true perianth, its place being usually supplied by glumes. Stamens 2—3, adherent to 4—6 glumes, or the latter sometimes absent; anthers generally 1-celled; ovary 1—3-celled, with 1 pendulous ovule in each cell. Fruit capsular or nut-like. Seeds albuminous, without hairs; embryo lenticular and terminal. The plants of this order are principally natives of South America, South Africa, and Australia. There are 25 genera, and 171 species. Their properties are unimportant. The wiry stems of some species have been used for basket-making, thatching, rope, &c.

RESUSCITATION. (*See* DROWNING.)

RETE MUCOSUM. (*See* SKIN.)

RETENTION OF URINE, *re-ten'-shun.*—In Medicine, a term signifying a holding of urine in the bladder from a want of power to discharge it. There is a very important difference between *retention* and *suppression* of urine, inasmuch as in the latter case, no urine is in the bladder. The various causes of retention of urine may be divided into *Organic* and *Functional*; chief among the former are permanent stricture, also contraction of the urethra, tumours or foreign bodies in the urethra and, especially in the case of elderly men, enlargement of the prostrate gland. The two chief functional causes are spasmodic stricture—*i.e.*, spasm of the urethra and debility or paralysis of the muscles of the bladder and urethra. When the patient finds himself unable to urinate, although the desire and the efforts to do so are great, he should at once consult a thoroughly competent medical man. The bladder may have to be evacuated by means of a catheter, an operation giving relief but requiring very skilful manipulation; the after treatment depends upon various other symptoms, which would guide the doctor in the choice of remedies and method of treatment. Very often, in women, retention of urine is due to hysterical causes.

RETICULATED, *re-tick'-u-lay-ted.*—A term applied to leaves with veins like net-work. (*See* LEAF.)

RETINA. (*See* EYE.)

RETORT, *re-tort'* (Lat., *retorqueo*, I bend back, from the curvature of its neck).—A chemical vessel in which distillation is effected by means of heat. Retorts are made of glass, earthenware, or metal, according to the purposes for which they are intended. Glass retorts are employed for the preparation of those substances which do not require any extraordinary degree of cold for their condensation; such as nitric acid. Glass retorts are made of various sizes, capable of holding four or five ounces to several gallons, and both flint and green glass are used in their manufacture. They are usually heated either by spirit-lamp, by gas, or by sand-bath. When higher temperatures are required, earthen retorts are used. In making hydrofloric acid, a lead retort is necessary; and in concentrating sulphuric acid, platinum retorts are largely employed. Very large earthenware retorts are used in the manufacture of coal gas.

RETRIEVER, *re-treev'-er.*—A variety of dog, usually cross-bred, either between the Newfoundland and smooth coated setter, or between the Newfoundland and curly coated water-spaniel. The retriever is specially trained to retrieve—*i.e.*, search for, and bring back game, which the sportsman has shot—hence its name. The training is a matter requiring much patience and perseverance, so that the dog shall not be diverted from its search by any other creature than the object of its pursuit. Other intelligent dogs such as the setter, spaniels, are also taught to retrieve game. The usual colour of the retriever is black.

RETROGRADE, RETROGRADATION, *re'-tro-grade.*—In Astronomy, a term given to the apparently backward motion of the planets and comets among the fixed stars—*i.e.*, backward in that they appear to move in a contrary direction to the order of the signs of the Zodiac. (*See* ZODIAC.) The superior planets appear to move in this way when they are in or near opposition, because the earth is moving more quickly forward and so seems to leave them behind; the inferior planets appear to move backward when they are in or near inferior conjunction, because they are then between the centre of motion and the earth.

REVALENTA ARÀBICA, *rev-el-en'-tah, Ar-a'-bee-kah.*—The name given to a preparation of lentil flour (the lentil is the *Ervum Lens*), much vaunted as a remedy for various ills. Dr. Hassall, gives its composition as a mixture of the *red* or Arabian lentil, barley flour, and sugar or salt.

REVULSION, *re-vul'-shun.*—In Medicine, means the act of drawing a disease from one part of the body to another. (*See* DERIVATION, COUNTER-IRRITANTS.)

RHÆTIC BEDS, *ree'-tick.*—In Geology, a series of strata, extensively found in the Rhætian Alps, and forming the uppermost portion of the Trias. There are beds belonging to this group of strata found in Britain; they are highly fossiliferous.

RHAMNACEÆ, *ram-nai'-se-e* (from *Rhamnus*).—In Botany, the Buckthorn family, a natural order of *Dicotyledones*, sub-class *Calyciflorœ.* Small trees or shrubs, with simple leaves, and small, regular, usually perfect flowers; rarely unisexual. Calyx 4—5 cleft, valvate. Petals and stamens distinct, perigynous, and equal in number to the divisions of the calyx; occasionally the petals are wanting; the stamens alternate with the divisions of the calyx, and opposite the petals when these are present. Ovary more or less superior, surrounded by a fleshy disc. Fruit dehiscent or indehiscent, 2, 3, or 4-celled, with one erect seed in each cell. Seeds usually albuminous, without an aril. The *Rhamnaceœ* are distributed over the globe, except in the very coldest regions. There are 42 genera and 250 species. Some are acrid and purgative; others bitter, febrifugal, and tonic. A few are used in the preparation of dye-stuffs, and a few have edible fruits. (*See* RHAMNUS).

RHAMNUS, *ram'-nus* (Gr., *rhadamnos*, a young branch or sprout, because divided into many branches).—In Botany, the typical genus of the natural order *Rhamnaceœ.* It includes many interesting and useful species. *R. Catharticus*, the buckthorn, produces a fruit which has been for ages employed medicinally as a cathartic; at the present time it is seldom used, on account of its violent and unpleasant operation. The colour called *sap-green* is prepared by evaporating the juice of buckthorn-berries, previously mixed with lime. The bark of *R. Frangula*, the black alder, possesses purgative and alterative properties, and is reputed to be efficacious in various cutaneous affections, rheumatism, secondary syphilis, &c. A greenish or yellowish dye is made from the leaves. The unripe fruit of *R. infectorius* is known in commerce as *French berries*, or *graines d'Avignon;* while those of *R. Amygdalinus* constitute *yellow* or *Persian berries.* Both kinds are used to produce a beautiful yellow dye, chiefly applied to morocco leather. The Chinese green dye (*Lo-rao*), now much used in Europe, is prepared from *R. chlorophorus* and *utilis.* A blue dye is prepared from *R. alaternus.* In Abyssinia, the leaves of *R. pauciflorus* and the fruit of *R. Staddo*, both of which possess bitter properties, are used in place of hops in the preparation of beer.

RHATANY, *rat'-an-y.* (*See* RATTANY.)

RHEEA FIBRE. (*See* URTICA.)

RHESUS MONKEY, *ree'-sus.*—One of the most mischievous of all the monkey tribe. It is found in India, where it is held in great veneration, apparently because the natives fear to arouse its anger lest it should destroy their crops while green. It lives in troops in the forest, visiting fields and plantations for the purpose of stealing the grain, which it then stores up for use. It is short and stout, having, moreover, short ears and a short tail, large callosities, loose skin about its throat and belly. The back is brown, but the haunches almost orange colour. In summer it is found as far north as the Himalaya regions, from which, however, it migrates in the winter. (*See* MONKEY.)

RHEUM, *re'-um* (said to be derived from *Rha*—now Wolga—from whose banks it was first brought.)—In Botany, Rhubarb, a genus of the natural order *Polygonaceœ.* The species of this genus are all more or less remarkable for their purgative and astringent properties; and their roots, which contain the largest proportion of the active principles, are largely used as medicinal agents. The exact source of our officinal rhubarb has not been definitely ascertained. Dr. Royle states that the rhubarb country, whence Turkey or Russian rhubarb is derived, is in the heart of Thibet, within 93° of E. long. and 35° degrees of N. lat.; and as no naturalist has visited this part, and as neither seeds nor plants have been obtained thence, it is as yet unknown what species yields the rhubarb. It is known that the greater part of the rhubarb of commerce is grown in this district, and is obtained in summer from plants six years of age. When dug up, it is cleansed, peeled, and cut into pieces. These are bored through the centre, strung on a string, and dried in the sun. In the autumn, the rhubarb is conveyed to Sinin, where the Bucharian traders reside, and thence to the Russian frontier town of Kiachta, and to Pekin, Canton, and Macao. This is, unquestionably, the best kind of rhubarb. Chinese, or East Indian rhubarb, is the produce of an unknown species of *rheum*, cultivated in the Chinese empire. Himalayan rhubarb is obtained from several species, particularly *R. Moorcroftianum*, *Webianum*, and *Emodi*. English rhubarb is the root of *R. Rhaponticum*; it is now extensively employed in the hospitals of this country and in America, but it is not so active as the officinal rhubarb. The so-called "genuine Turkey rhubarb," sold in the streets by turbaned hawkers, is almost invariably English rhubarb. The leaf-stalks of *R. Rhaponticum* and other species are largely employed as a substitute for fruit in pies and puddings. Their pleasant acidity is due to the presence of oxalic and malic acids. The leaf-stalks of *R. Ribes* are used in the East in the preparation of sherbet. Crystals of oxalate of lime occur abundantly in the roots of the species of this genus. (*See* RAPHIDES.)

RHEUMATISM, *ru'-ma-tizm* (Gr., *rheumatismos*, a defluxion).—In Medicine, is one of the most common and painful diseases of this country. It is characterized by an inflamed state of the fibrous tissue, and wherever fibrous tissues are found there may be rheumatism; but it principally affects the larger joints and places covered by muscles, as the wrists, elbows, knees, hip-joint, back, and loins. When the joints about the back and loins are affected, it is called lumbago; when the pain is in the hip-joint, sciatica; and when the muscles of the chest are affected, pleurodyne. Rheumatism may occur either with fever or without it, being in the former case termed acute, in the latter chronic. Acute rheumatism, or rheumatic fever, may happen at any time, but occurs more particularly in autumn, and affects chiefly such as are in the prime of life. It is generally occasioned by exposing the body to cold air immediately after having been heated, and commences with chilliness and shivering, which are soon followed by heat, restlessness, and other feverish symptoms. An acute pain is soon after felt in one or other of the limbs. This quickly increases, and in a short time is accompanied with swelling and great tenderness of one or more of the large joints, with much constitutional disturbance The patient's sufferings are now of the most agonizing character. He is restless, and yet dare not or cannot move; even the weight of the bed-clothes can scarcely be borne. The pulse is full and bounding, the skin is generally bathed in perspiration of a disagreeable sour odour, the bowels are constipated, the urine scanty and high-coloured, loaded with uric acid or urates. This disease varies considerably in intensity and duration, and may terminate in a few days or endure for several months. Its average duration, however, when uncomplicated with other diseases, is from ten to eighteen days. One remarkable feature of it is its tendency to move from one part to another, often suddenly leaving one joint and making its appearance in another, and again going back to its original seat. It is seldom, if ever, a fatal disease, except when it attacks some vital organ, as the heart, which in severe cases it is very apt to do. It is a constitutional disease, arising from a poison circulating in the blood. This poison constitutes that predisposition to the disease without which it would not occur, and the cold probably exercises its injurious influence by checking the elimination through the skin, and other emunctories, of the poisonous principle as it forms, and by thus accumulating it in the blood. Medical men are by no means agreed as to the treatment best adapted for this complaint. In general, however, when the patient is young and robust, and when the inflammatory fever is high, bleeding from the arm is recommended. Wherever the pain is very acute, opium will be found to be a very useful and necessary remedy. The free administration of active purgatives, particularly at the outset of the disease, is found to be very beneficial. Alkaline drugs are by many strongly recommended in this disease, as being chemical antagonists of the poison. "Alkalies, or the alkaline salts," says Dr. Watson, "are always, in my opinion, fit remedies to be employed in the treatment of acute rheumatism. They may be added largely to the common effervescing saline draught, or they may be simply dissolved in water. Together with them, blood-letting, calomel, purgatives, opium, and colchicum, may be variously combined, according to the special circumstances of the case." The favourite remedy of the late Dr. Golding Bird in this and in some other blood diseases, was the acetate of potash, in quantities of half an ounce, administered largely diluted, in divided doses in twenty-four hours; and "I do not hesitate to declare," he says, "that I have never seen the disease in question yield with so much facility to any other remedy." The chronic form of rheumatism is sometimes the sequel of the acute, but it is more commonly a separate constitutional affection, coming on independently of any previous acute attack. There is commonly little constitutional disturbance, but the sufferer is constantly annoyed, and his existence made miserable, with chronic pains, which destroy his comfort by day and render him restless by night. In some instances, the pains are worst at night, being aggravated by the warmth of the bed; in others, warmth affords the greatest relief. The cure of this complaint is tedious, and often very difficult. It frequently involves and cripples some of the smaller joints, especially those of the knuckles and fingers, rendering them nobby, and distorting their form and position. It is of the utmost importance in such cases that the patient be protected from the vicissitudes of the weather by warm clothing; and those who can afford it do well by taking up their residence in a warm climate. Warm bathing, vapour, and hot-air baths, with frequent friction and the use of the flesh-brush, are of great service, and stimulating internal medicines, as turpentine, are often of use. Five-grain doses of iodide of potassium, combined with a few grains of carbonate of ammonia three times a day, are now spoken of among the most efficacious of all remedies. Cod-liver oil is also sometimes recommended, with bark, iron, and other tonics, for invigorating the system. Persons subject to chronic rheumatism should also be very careful in their diet, as there is little doubt that many of the paroxysms of this disease are brought on by a disordered state of the digestive organs.

RHINANTHUS, *rin-an'-thus*.—In Botany, the name of a genus of plants of which the Yellow Rattle (*R. crista-galli*, also called The Cock's Comb, because of the fringed bracts) is the most common specimen. The genus belongs to the natural order *Scrophulariaceæ* and has an inflated calyx, four-toothed, the upper lip of the corolla being compressed laterally, and both sides furnished below the tip with a straight-like capsule, compressed and 2-celled. The Yellow Rattle is an annual growing from one to two feet high, bears yellow flowers, and somewhat large capsules in which when ripe, the seeds rattle—hence its name.

RHINOCEROS, *ri-nos'-e-rous* (Gr., *ri-nos'-er-os*).—The name of a genus of pachydermatous quadrupeds, having each foot divided into three toes, and furnished with one or more horns on the snout. They were well known to the ancients, and are frequently alluded to by the writers of past ages. The first rhinoceros, however, seen by modern Europeans, appears to have been a one-horned rhinoceros sent from India to Emmanuel, king of Portugal, in 1513. No two-horned rhinoceros seems to have been brought alive to Europe in modern times. The bony framework of the animals of this genus approximates to that of the *hyrax*, the tapir, and the horse, among living genera; but, although a general resemblance pervades the entire skeleton of the animals of this genus, there are certain differences, in the skull especially. The rhinoceros, generally speaking, is a clumsy and deformed-looking animal; the upper lip is very large, and overhangs the lower, and being furnished with strong muscles, is employed by the animal somewhat as the elephant uses his trunk. The ears are large, erect, and pointed. The skin is naked, rough, and extremely thick—about the neck it is gathered into large folds; a fold also extends between the shoulders and fore-legs, and another from the hinder part of the back to the thigh. The tail is slender, flat at the end, furnished at the sides with very stiff black hairs. The legs are very short. The rhinoceros lives in shady forests adjoining rivers, or in swampy jungles. Though possessed of great strength, and more than a match for either the tiger or the elephant, it is quiet and inoffensive unless provoked. Its chief food is canes and shrubs, roots and small branches of trees. Its senses of smelling and hearing are very acute, but its sight is by no means vivid. The female produces one at a birth. The growth of the young is very gradual, and at the age of two years it scarcely attains half its height. Though there are considerable differences of size among the living species of the genus, they are all large animals, and powerful in proportion to their size; and, as existing, are all natives of the eastern continent, and the most tropical parts of it. As now existing, the rhinoceros may be considered as the most aquatic of all the *pachydermata*, excepting the hippopotamus, and the ones which, next to it, feed upon the rankest and coarsest vegetation. They have a slight tendency to be gregarious, but never assemble in such herds as the elephants. There are several species of rhinoceros, of which we particularize the principal.

The Indian Rhinoceros (*R. Indianus*) has only one horn, and is a native of India, particularly of that part which lies beyond the Ganges. When full-grown, it is about eight or nine feet in length, and four feet high.

The African Rhinoceros (*R. Africanus*) resembles the preceding, in many particulars, but differs in being provided with an additional horn, of a smaller size, situated near the forehead, also in that the horizontal contour of the bones of its nose is rounded, whilst in the one-horned species it is pointed; and that its skin is not thrown into the folds, so remarkable in the latter. The two-horned rhinoceros was the one best known to the ancients, and is frequently represented on their coins, especially those of Domitian. Strabo, however, gives a clear description of one that was one-horned. The black African rhinoceros, or *Bovele*, is the smallest of all known species, though the white (*R. simus*) is much larger.

The Rhinoceros of Java (*R. sondiacus*) is another species, with only one horn, and is even smaller than the Indian species, its length from the membrane of the tail to the tip of the nose being about eight feet, and its height not more than four. Its horn always appears to be much used by the animal in some operation or other, for it is ground or rubbed down, and is sometimes reduced to little more than an inch in length. The skin of this species is very much plaited behind the shoulders, under the neck, and on the outsides of the legs, and is roughened by prominent tubercles, for the most part in the shape of regular pentagons, well defined. The Indian and Java rhinoceros are the only one-horned species which are now to be found in the living state; and as the greater part, if not the whole, of those which are found fossil in the colder latitudes, appear to have had two horns, the one-horned species would seem to have been, in all ages of the world, confined to the localities in which they are now found. It is worthy of notice that the skin of the two-horned ones is more free from plaits and tubercles, and more plentifully covered with hair, than are those which inhabit the most equatorial climates.

The Sumatran Rhinoceros (*R. Sumatrensis*) is a smaller species than the two-horned rhinoceros of Africa, but, like that, is more an animal of the interior of the country than the Indian species, or that of Java. In the specimens that have been seen by Europeans, it is only five or six feet in length, and between three and four in its greatest height. Its skin is without the decided folds which mark the single-horned ones, and also the wrinkles which more or less pucker the skin of the African species, and is altogether softer and thinner than that of the others.

RHINOPLASTIC OPERATION, *rin-o-plas'-tick* (also called the *Taliacotian* operation, because it was first performed by Taliacotius of Bologna).—An operation for restoring the whole or a portion of the nose, which may have been destroyed by accident or disease. It is a difficult operation, and is mainly performed by transplanting skin from a healthy part adjoining.

RHIPIPTERA. (*See* STREPSIPTERA.)

RHIZO-BOLACEÆ, *ri-zo-bo-lai'-se-e* (Gr., *rhiza*, a root).—In Botany, the Souri-nut family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*. Large trees, natives of the forests of the hottest parts of South America. Leaves opposite, digitate, exstipulate, with articulated stalks. Flowers regular, hypogynous. Petals equalsided, and inserted with numerous stamens into a hypogynous disc. Styles very short. Seeds solitary, exalbuminous, with a very large radicle, and two small cotyledons. There are but two genera, including eight species. Some are valuable for their timber; others yield an excellent oil; and some edible nuts. (*See* CARYOCAR.)

RHIZOGENS, OR RHIZANTHEÆ, *ri'-zo-genz, riz-an'-the-e* (Gr., *rhiza*, a root; *gennao*, I produce; *anthos*, a flower).—In Botany, these names have been given by some botanists to a group of natural orders (*Balanophoraceæ*, *Cytinaceæ*, and *Rafflesiaceæ*) supposed to constitute a distinct class between the *Cryptogamia* and *Phenerogamia*. The special characteristics of the rhizogens are said to be the acotyledonous embryo, the fungoid texture, and the peculiar parasitic habit of such plants. Professor Bentley thinks that as one or more of such characters occur in several orders of *Dicotyledones*, there are no sufficiently valid reasons for separating the rhizogens from that class.

RHIZOME, OR ROOTSTOCK, *ri'-zome* (Gr., *rhizoo*, I support by roots).—In Botany, a thick fleshy stem, lying on the surface of the earth or partly beneath it, giving forth roots from its lower side, and shooting forth leaves every spring. It is commonly mistaken for a root. It is conspicuous in the plant called the iris and in Solomon's seal.

RHIZOPHORA, *ri-zof'-o-ra* (Gr., *rhiza*, a root; *phero*, I bear or carry).—In Botany, the typical genus of the natural order *Rhizophoraceæ*. The species *R. mangle* is the mangrove-tree of tropical sea-shores. It is remarkable for the aërial roots thrown off from the stem, which, fixing themselves into the mud, act as props to keep the tree in an erect position. It frequently happens that these aërial roots form the entire support of the stem, in consequence of the decaying of its lower part. The bark of the mangrove-tree is sometimes imported into this country as a tanning material. The fruit is sweet and edible, and its juice, when fermented, forms a kind of wine.

RHIZOPHORACEÆ, *ri-zof-o-rai'-se-e* (from Rhizophora).—In Botany, the mangrove family, a natural order of *Dicotyledones*, sub-class *Calyciflorœ*. Trees or shrubs with simple opposite leaves (dotless, or rarely dotted), having deciduous interpetiolar stipules. Calyx superior, 4—12-lobed, with a valvate æstivation, the lobes sometimes united so as to form a calyptra; petals arising from the calyx alternate with the lobes, and equal to them in number; stamens on the calyx twice or thrice as many as its lobes, or still more numerous; ovary inferior, 2, 3, or 4-celled, each cell with two or more pendulous ovules. Fruit indehiscent, 1-celled, 1-seeded, crowned by the calyx. Seed pendulous, exalbuminous, usually germinating while the fruit is still attached to the tree. The plants of this order are natives of the muddy sea-shores in the tropics, and are generally remarkable for their astringent properties. There are five genera and 20 species. (*See* RHIZOPHORA.)

RHIZOPODA, *riz-op'-o-da* (Gr., *rhizon*, a root; *poda*, feet).—In natural History, a name given by M. Dujardin to a new class of animals of lower degree than the *Radiata*, possessing a power of locomotion by means of minute tentacular filaments. The rhizopoda comprize the animals which constructed the *miliola* shells found in such large quantities in the strata of many quarries near Paris. The class also includes some other microscopic foraminiferous shells.

RHODIUM, *ro'-de-um* (Gr., *rhodon*, a rose, on account of the red colour of some of its salts). —Symbol Ro or Rh, specific gravity 12·1. Atomic weight, 104. Rhodium was discovered by Wollaston in 1804, and is one of the rare metals found in platinum ores. It is very hard, white, and brittle, and, with the exception of iridium, one of the most infusible of metals. When pure, it is insoluble in acids, but when alloyed with platinum, bismuth, or copper, it is dissolved with them in aqua regia. Heated in contact with chloride of sodium in a current of chlorine, the double chloride of rhodium and sodium is formed. The only use to which rhodium has been applied is to form the nibs of metallic pens, for which it is extremely well fitted, from its hardness and unalterability. It forms two definite oxides—RoO and Ro_2O_3. The latter only forms salts. Rhodium forms two sulphides—RoS and Ro_2S, and three chlorides—$RoCl$, Ro_4Cl_5 and Ro_2Cl_3. The sesquichloride forms double salts with the soluble chlorides, which crystallize in octahedra or cubes of a delicate rosy hue; hence the name of the metal.

RHODODENDRON, *ro-do-den'-dron* (Gr., *rhododendron*, from *rhodon*, a rose; *dendron*, a tree).—In Botany, a genus of shrubs belonging to the natural order *Ericæ*. Many species are largely cultivated in this country on account of the beauty of their flowers. The narcotic properties which characterize the whole genus are particularly evident in the flowers of *R. arboreum*, which are eaten by the hill people of India, and in all parts, of *R. chrysanthum*, a Siberian plant. The powdered leaves of *R. panulatum* are used as snuff in some parts of India. The brown pulverulent substance found on the petioles of some rhododendrons and kalmias is also used in the American States as snuff. (*See* ERICÆ.)

RHODOMENIA, *ro-do-me'-ne-a* (Gr., *rhodos*, red; *humen*, a membrane).—In Botany, a genus of *Algæ*, or sea-weeds. *R. palmata* is an article of food in Scotland, Ireland, and Iceland. It is the *dulse* of the Scotch, and the *dillesk* of the Irish. It is very nutritious and wholesome.

RHODORIZA, *ro-do-ri'-za.*—In Botany, a genus of the natural order *Convolvulaceæ*. The volatile oil called *oil of rhodium* is obtained from species of this genus. The powdered wood is used for fumigation and as snuff.

RHOMBOID, RHOMBUS, *rom-boid'*, *rom'-bus* (Lat.).—In Geometry these terms have been used by various writers with different significations. The former term was generally applied to a parallelogram, and the latter to an equilateral parallelogram. At the present day, when either of the terms is used, it signifies an equilateral oblique parallelogram.

RHUBARB. (*See* RHEUM.)

RHUS, *rus* (Gr., *rhous*, the Attic contracted form of *rhoos*, a stream, from the wide-spreading of its roots).—In Botany, the Sumach, a genus of the natural order *Anacardiaceæ*. The species are generally characterized by poisonous properties and a milky juice, which becomes black on exposure to the air. *R. Toxicodendron* is the poison-oak of North America. Its leaves contain a peculiar acrid principle, and are thought to be useful in the treatment of old paralytic cases and chronic rheumatism. This plant is, by some botanists, considered as merely a variety of *R. radicans*, which has similar properties. *R. venenata*, the poison-ash, or poison-elder, like the two former species, is extremely poisonous. When in a fresh condition, all parts of the above plants require to be very carefully handled, as their juices frequently excite violent erysipelous inflammation. The bark of *R. Coriaria* is a powerful astringent, and is used for tanning; its fruit is acidulous, and is eaten by the Turks. The dried and powdered leaves of the *R. cotinus* constitute the well-known tanning and dyeing agent called *shumac*, or *sumach*, which has been in use for ages. The wood of the same species is also known in commerce as *young fustic*, or *Zante fustic*. It is used in dyeing to produce a rich yellow. *R. Metopium*, a native of Jamaica, furnishes the *hog-gum* of that island, which is said to be astringent, diuretic, and purgative, when used as an internal medicine, and to act as a vulnerary when applied externally to wounds and bruises. The substance called *Japanese wax*, now largely used as a candle material, is obtained from the fruits of *R. succedaneum* and other species.

RHYNCHONELLA, *rin-con-el'-la.*—A genus of brachiopodous mollusca, of which there are two living, and upwards of 260 fossil species. The shell is beaked, and the dorsal valve elevated in front.

RHYNCHOPHORA, *rin-ko'-for-a.* (*See* WEEVIL.)

RHYNCHOPS. (*See* SKIMMER.)

RIBBON-FISH.—The common name of a family of fishes (*Tæniidæ*), nearly allied to the mackarel (*Scomberidæ*), though they are of a compressed and elongated form. Their structure is very delicate, the skin silvery and naked, the snout protractile, the mouth small, and a long dorsal fin often uniting with the tail-fin. (*See* BAND-FISH.)

RIB GRASS, RIB WORTS. (*See* PLANTAGINÆ.)

RIBES, *ri'-beez* (Arabic name, properly belonging to an acid-leaved species of *Rheum*, but which, for about two hundred years, has, by mistake, been applied to the currant and gooseberry tribe).—In Botany, a genus of the natural order *Grossulariaceæ*. Some of the species are remarkable for their agreeable and wholesome acid fruits, and are on this account much cultivated in our gardens. *R. Grossularia* is the source of the numerous varieties of gooseberries, so much used both in the unripe and ripe condition for tarts and puddings, for making wine, and for dessert. *R. rubrum* yields both red and white currants, and *R. nigrum* black currants. These are used for the same purposes as gooseberries, and are particularly adapted for making jams and jellies. An infusion of black currants is much used under the name of black-currant tea as a cooling drink in fevers.

RIBS, *ribz* (Sax.).—In Anatomy, are the long curved bones which form the walls of the chest. They extend in an oblique direction from the vertebræ of the back to the sternum in front. They are usually twelve on each side; but in some rare cases thirteen have been found, in others only eleven. They are distinguished into true and false; the former being the seven upper ribs, which are articulated to the sternum; the latter the five lower ones, which are not immediately attached to that bone. The use of the ribs is to cover and defend the lungs and heart; and their articulation with the vertebræ and sternum admitting of a slight motion, they assist in respiration. (*See* under sub-heading Osteology, of the article ANATOMY, also THORAX.)

RICE, *rice.*—In Botany, a genus (*Oryza*), of the natural order *Graminaceæ*. *O. sativa* is the rice-plant, the grain of which is more largely consumed as food than that of any other cereal. Rice is extensively cultivated in India, China, Japan, &c., chiefly on low grounds, near large rivers, which are liable to be annually inundated and enriched by the deposition of mud. In the Southern States of America, it has long been a staple commodity. From forty to fifty varieties of the rice-plant are known and cultivated in different countries and situations. As an article of food, rice appears to be less nutritive than the other cereal grains: it is of a binding nature, hence its use in diarrhœa. Spirit is sometimes distilled from the fermented infusion of rice: this spirit is frequently called *arrack*; but that name is properly applied only to spirit distilled from palm wine. Starch of excellent quality for laundry purposes is now manufactured from rice.

RICE-PAPER. (*See* ARALIA.)

RICHARDSONIA, *ritsh-ard-so'-ne-a.*—In Botany, a genus of the natural order *Cinchonaceæ*. *R. scabra*, or *braziliensis*, contains the active principle *emetina* in its root, which is used in some parts as a substitute for the true ipecacuanha, under the names of undulated, white, and amylaceous ipecacuanha.

RICINUS, *ris'-e-nus* (Lat., *ricinus*, a tick, which its seed resembles).—In Botany, a genus of the natural order *Euphorbiaceæ*. *R. communis* is the Palma Christi, or castor-oil plant, a native of India. Castor-oil is obtained from the seeds, either by expression with or without the aid of heat, or by decoction, or sometimes by the aid of alcohol; that employed in England is obtained by expression solely. Castor-seeds, when taken whole, are extremely acrid, and have produced death; but the expressed oil is a mild and most efficient non-irritating laxative. Its valuable properties are principally owing to the presence of an acrid resin. The so-called *concentrated castor-oil*, which is sold in gelatine capsules, is adulterated with croton-oil; and hence may produce serious effects when administered in certain cases. The Palma Christi has been recently cultivated in Algeria for the purpose of feeding silk-worms on the leaves.

RICKETS, OR RACHITIS, *rik'-ets* (Gr., *rhachis*).—Is a disease of the bones, in which they are of unnatural softness, and become bent under the weight of the superincumbent parts of the body. It is confined to the young, and when it appears, commonly shows itself between the first and third year. As soon as the weight of the body is thrown on the limbs, they become bent and twisted in the most extraordinary manner; the joints become enlarged, the chest and pelvis deformed, and the head large and swollen. The bones in this disease are found to be soft and cellular, and deficient in earthy matter. In addition to this, the mucles are always pale and weak, with other signs of general debility; besides which the brain, and organs contained in the chest and abdomen, are liable to suffer. The nature of this disease requires that its treatment be directed chiefly to strengthening the general constitution by a good and well-regulated diet, pure air, warm clothing, bathing, and such active exercise as may be borne without fatigue.

RIGHT ASCENSION. (*See* ASCENSION, RIGHT.)

RIGID DYNAMICS. (*See* DYNAMICS.)

RIGOR MORTIS.—The stiffness, or rigidity of the body which follows death. (*See* DEATH.)

RINDERPEST. (*See* CATTLE PLAGUE.)

RING-OUSEL, *ring-oo'-zel.*—In Scotland known as the Moor Blackbird (*Turdus torquatus*, or *Merula torquata*), a species of thrush, slightly larger than the blackbird; it passes the winter in the south of Europe, visiting the more northern regions in summer; its colour is dark brown, and it has a ring of white on the throat. It frequents mountain slopes and heaths.

RINGWORM, *ring'-wurm* (Lat., *porrigo*).—In Medicine, is an eruptive disease of the skin, more particularly on the head, of which there are several kinds. The most common kind commences with clusters of small light-yellow pustules, which soon break and form thin scabs, which, if neglected, become thick and hard by accumulation. When removed, they appear again in a few days; and by these repetitions the encrustations become thicker, and the area of the patches extends, so as, if unchecked, to affect the whole head, and extend also to the forehead and neck. The patches are of an irregular circular form. This disease occurs generally in children of three or four years and upwards, and often continues for several years. It is said to occur spontaneously in children ill-fed and uncleanly, and is readily propagated by contagion. The principal local treatment, when the patches are in an inflamed and irritable condition, consists in regular washing or sponging with warm water and carbolic soap, and the hair should be clipped close round each "ring" to prevent the spread of the complaint. Sulphurous acid, either alone or mixed with a little water, will be found a good application, while oleate of mercury, tincture of iodine (this more especially if the complaint be on the body), and tincture of steel are also recommended. Iodine liniment is sometimes used, and is said to be an infallible cure, but as it is a very powerful remedy it should only be used at the recommendation of a doctor. When the inflammatory state is diminished, and a dry scaly scab appears, olive oil rubbed on will help to remove it. Further, a nutritious diet, warm clothing, tonics, and regular exercise are necessary.

RIVER CRAB.—A genus of crabs (*Thelphusa*) found in fresh water in warm countries, and having short antennæ and quadrilateral carapace. One species (*Thelphusa cunicularis*) is found in India, and another (*T. depressa*) is found in the south of Europe, where it is esteemed as an article of food.

RIVERS.—Inland currents of water, which bring down to the sea, to a lake, or to another river, the waters which are collected within a certain portion of the earth's surface. Rivers can be traced either to springs or to the gradual melting of the ice and snow which perpetually cover the summits of all the most elevated mountain-ranges on the earth. The union of several springs, or of these meltings, forms rivulets; these flow down and meet with other rivulets, till they reach one great channel, when the stream is called a *river*. The country through which a river runs is called its *basin*, as the stream runs in the lowest part of it, and the country, on all sides, rises with more or less steepness, similarly to the sides of a basin. Nearly all large rivers have their sources in lofty mountains or elevated table-lands, in descending from which a great difference with respect to the rapidity of their course is observed. In physical geography, therefore, the course of such rivers is divided into three parts—the upper, middle, and lower course. The size of a river depends upon three circumstances—the surface of its basin, the abundance of that surface in springs, and the degree of humidity of the region from which it draws its supplies. From these causes arises the vastness of the South American rivers. The peculiar situation of the Andes with regard to that continent, the fact that by far the largest portion of its running water is drained off towards the Atlantic, the great number of streams that intersect the country, together with the humidity of the climate, all combine to form large rivers. As the Andes are placed so near the Pacific, the rivers which flow into that ocean are small, while those which flow into the Atlantic, having such an immense space to traverse, are swelled into an enormous volume, In the Old World, the physical circumstances are not of a similar character; hence there are no vast rivers like those of the New World. Europe is too small, Africa for the most part is an arid, sandy desert, while in Asia generally the climate is not so moist, and capacious inland lakes form natural reservoirs for holding the streams which fall into them. After leaving its source, the water of a river, by following a descent, receives an impulse which is sufficient to keep the stream in motion, even when there is no longer a declivity on the ground. The only effect produced is that the course of the stream becomes gradually slower in flowing over a level. The declivity of many rivers is much less than might be conjectured. The Amazon has a descent of only ten and a half feet in two hundred leagues—that is, only one twenty-seventh part of an inch for every thousand feet of that distance. In France, between Pouilly and Briare, the Loire falls one foot in 7,500, but between Briare and Orleans, only one foot in 13,596. The Rhine itself in some parts has not a descent of more than four feet in a mile. In flowing through mountainous districts, rivers frequently fall over precipices, and form *cataracts*, many of which are of great depth. When the water descends with great velocity over an inclined plane of rock, it is said to form a *rapid*. The most celebrated waterfalls in the world are those of Niagara, in North America. Most of the rivers in the tropics are subject to periodical overflowings of their banks, in consequence of the rains which fall every year in such abundance during the wet season. Amongst the ancients, the overflow of the Nile was looked upon as one of the greatest mysteries in nature, as in Egypt rain scarcely ever falls. It is now understood that the phenomenon occurs through the rains which descend on the mountains in the interior of Africa, where the Nile rises. Some rivers disappear mysteriously underground for a certain distance. This is caused by a river being impeded in its course by a bank of solid rock, at the bottom of which it finds a bed of softer soil: having washed and worn away the latter, it works for itself a subterranean passage. In this way can be explained the sinking of the Rhone between Seyssel and L'Ecluse, and the formation in Virginia of the celebrated rock bridge. In Spain, the waters of the Guadiana are dispersed in sandy and marshy grounds, from whence they afterwards emerge in greater abundance. At their junction with the sea, rivers present several features worthy of note. The opposition which takes place between the tide and their own currents frequently causes the collection at their mouths of banks of sand or mud, which are commonly called "bars," on account of the obstacles which they present to navigation. Many of the largest rivers flow into the sea with only one outlet, while others, before their termination, divide into several branches. Among the latter may be mentioned the Nile, the Ganges, the Rhine, the Volga, and the Orinoco. This feature depends partly upon the nature of the country through which the river flows, and partly upon the diminished velocity of the current. The following are the lengths of some of the principal rivers in the world in English Miles:—

Amazon, 4,095; St. Lawrence, 4,050; Mississippi, 3,420; Plata, 2,430; Nile, 2,330; Kang-tse, or great river of China, 3,870; Amoor, 2,880; Lena, 2,430; Indus, 2,070; Don, 1,350; Dnieper, 1,390; Danube, 1,750; Vistula, 760; Elbe, 820; Po, 400; Loire, 720; Rhine, 810; Thames, 180.

According to Baron Humboldt, the area of drainage of the Amazon river measures 3,000,000 square miles. The area of the basin of the Thames is 6,500 square miles.

ROACH, *roatsh* (Sax., *hreoce*).—The roach (*Leuciscus rutilus*) is a fish about twelve or fifteen inches in length. The length of the head, compared with the whole length of the fish, is as 1 to 5; the depth, at the commencement of the dorsal fin, is to the body alone (without the head or tail) as 2 to 5. The scales are large. The colour of the back and the upper part of the head is bluish-green or dusky-green, becoming lighter on the sides of the body, and shaded into silvery white on the belly. The dorsal and caudal fins are dusky, tinged with red; the anal, pectoral, and ventral fins are bright red; the irides bright yellow. The roach is common in most parts of Europe, swims in large shoals, and frequents rivers, lakes, &c., preferring somewhat still and deep waters, feeding upon worms and aquatic vegetables. The roach spawns at the end of May or the beginning of June, and the scales are then rough to the touch. It is in little estimation generally for the table, but is best for food, as well as finest in colour, in October. The proverb, "As sound as a roach," is probably derived from the French; for in the older ichthyological works, this fish was called *roche*, and the meaning stands confessed, if we admit the pun upon the word, and we ought then to read "as sound as a rock."

ROARING, *ror'-ing.*—Is a name given to a disease of the horse, in which the air passages are affected, some of the muscles of the larynx being usually wasted. It is characterized by a grating, roaring noise during the inspiration of breath, or when the animal is galloping on heavy ground.

ROBIN REDBREAST. (*See* REDBREAST.)

ROBINIA, *ro-bin'-e-a* (after Jean Robin, botanist to Henry IV. of France).—In Botany, a genus of the natural order, *Leguminosæ*. The species *R. pseud-acacia* is known as the locust-tree, and frequently cultivated in this country on account of its flowers, and its hard and durable wood. It must not be confounded with the useful West-Indian locust-tree (*see* HYMENÆA), or with the plant producing the so-called locust-bean (*see* CERATONIA.)

ROCAMBOLE, *rok'-am-bole.*—The common name for *Allium Scorodoprasum*, a plant closely resembling garlic, *A. sativum*. The bulbs, which are cultivated for the same purposes as those of the latter species, are said to have a more delicate flavour.

ROCCELLA, *ro-sel'-la.*—In Botany, a genus of lichens. The species are known under the common name of *Orchella weeds*, and are extensively used in this country and elsewhere in the manufacture of the purple and red dyes called *archil* or *orchil*, and *cudbear*. In Holland, the blue dye-stuff called *litmus* is also prepared from these lichens. Orchella weeds are imported from various parts of the world; as the Canary and Cape de Verd Islands, the Azores, Angola, Madagascar, Mauritius, Maderia, South America, and the Cape of Good Hope. In commerce, the different kinds are distinguished by the names of the countries whence they are derived. It is remarkable that there is no colouring matter ready formed in these lichens; it is produced by the combined action of air and ammonia upon some colourless principles contained in them. (*See* ARCHIL, LECANORA, LITMUS.)

ROCHELLE SALT, *ro-shell'.*—A salt which received its name because it was discovered by a Rochelle chemist named L. Seignette, in 1672. Chemically it is tartrate of soda and potash ($C_8\ H_4\ K\ Na\ O_6\ 4\ H_2\ O$), and when pure it occurs in colourless prisms usually eight-sided and transparent. It is a mild and efficacious laxative, the dose being from ½ to 1 oz. dissolved in eight to ten parts of water.

ROCH ALUM, OR ROCK ALUM, also called RED ALUM and ROMAN ALUM.—A kind of alum found in masses and free from iron, but having a reddish colour from the soil in which it is dug. It is found principally at Civita Vecchia. An imitation of this alum is in use, made by reddening common alum with Armenian bole. The term Rock Alum is also given sometimes to pure alum when found in a hard mass.

ROCK CRYSTAL, *rok.*—A term applied in Mineralogy to a very fine variety of quartz (*See* QUARTZ.)

ROCK OIL. (*See* PETROLEUM.)

ROCK SALT.—The name given to common salt (chloride of sodium) when it occurs in a massive or crystallized and solid form. It is extensively diffused, and in some places forms quite mountainous masses. It is often mixed with various impurities.

ROCK SOAP.—A mineral found in a massive state, but soft and easily broken, and consisting of silica, alumina, peroxide of iron and water. It is greasy to the touch, and easily cut with the knife. It is used by artists for crayons.

ROCKING-STONES, *rok'-ing.*—A term applied to certain large detached rocks or stones, also called *logging* stones, which are found picturesquely situated in many parts of Britain. In general, they present the appearance of a huge mass of rock loosened in some convulsion of nature, with a slightly rounded base resting on a flat surface of rock below, and so evenly balanced that it can be moved or rocked by a single individual. Antiquaries have accounted for the occurrence of these rocks in various ways. According to Dr. Hibbert, "as they (rocking-stones) are products of every country where loose detached rocks of a particular structure have been submitted to the operation of atmospheric agents, it is to be expected that the fables assigned to their origin would be regulated by the peculiar mythology of the people among whom they have become the object of notice and wonder."

ROCKS. (*See* GEOLOGY.)

RODENTIA, *ro-den'-she-a* (Lat., gnawers).—An order of animals belonging to the class *Mammalia*, embracing the rats and mice, hares, rabbits, guinea-pigs, and other well-known animals. These animals have two great incisor teeth in each jaw, separated from the molar by a wide space, with which they could hardly seize a living prey, or rend flesh; they could not even cut aliments, but they might serve for reducing them, by continued labour, into fine molecules—in a word, for gnawing them; hence the term Rodents, or Gnawers, applied to this order. As these incisors have enamel in front only, their posterior border wears away more than their anterior edge, so that they are always kept set like a chisel, and enable their owner to attack the hardest vegetable productions, and frequently to feed on wood and bark. Their prismatic form causes them to grow from the root in proportion to the wearing down of their cutting edge; and this disposition to grow or push forward from the root is so strong, that if one of them is lost or broken, its antagonist, meeting with no opposition to keep it within bounds, develops itself so as to become monstrous. The lower jaw has no horizontal movement except from behind, forwards, and *vice versâ*, convenient for the action of gnawing; the molars consequently have flat crowns, the enamelled eminences of which are always transversal, so as to be in opposition to the horizontal movements of the jaw, and to be better adapted for trituration. In some genera these eminences are simple lines, the crown of the tooth being very flat, and these are more exclusively frugivorous; in others the eminences are divided into blunt tubercles, and these are omnivorous; whilst, in a few others again, the teeth have points, and the animals belonging to these genera more willingly attack other animals, and approximate to the carnivora. The hinder parts of the body of the rodents in general exceed their anterior ones, and this gives them a disposition to leap rather than walk. The brain of the rodents is nearly smooth, and without convolutions; the eyes are entirely directed laterally; the jaws are weak, and the forearms have scarcely any rotatory motion, and their two bones are nearly united. In the greater part of the details of their organization the inferiority of the animals is displayed; but some of them enjoy a certain dexterity, using their fore feet for carrying their food to their mouth; whilst others, again (the squirrels), climb trees with facility. Rodents are most abundant in temperate regions. In Europe and the north of Asia there are 81 species, 16 genera; in North America, 99 species, 19 genera; in Africa, 53 species, 16 genera; in India and its islands, 58 species, 10 genera; in South America and West India Islands, 89 species, 25 genera. About six species of rodents are found in Australia, and they all belong to the family *Muridæ*.

RODIYAS, *rod-i-yahs*.—An unfortunate and very degraded race in Ceylon, whose position has, however, greatly improved under British rule. Formerly they were treated as outcasts, and they existed in a condition of life worse even than the Pariahs of India. (*See* CASTE.)

ROE, ROEBUCK, *ro'-buk* (Dan., *raabuk*).—This, the most light and handsome of all our deer (*Capreolus Capræa*), is about 3 feet 9 inches in length, about 2 feet 3 inches in height in front, and about 2 feet 7 inches in height behind. Weight, from about 50 to 60 lbs.; length of horns, from 8 to 9 inches. The horns are cylindrical, with a small antler on the middle of the horn, pointing forward, and a second one higher up and turned to the rear. Their lower part is deeply furrowed longitudinally. Those of a young buck in its second year are simple; in the third year, a branch appears; the head is complete in the fourth year. The colour of the hair is a grayish yellow, varying more to reddish or brownish, but always with a large white disc on the buttocks. The lower part of each hair is ash-coloured; there is a narrow bar of black near the end, and the tip is yellow. On the face the hair is black, tipped with yellow. The summer and winter clothing differ a little, both in colour and texture: in summer the coat is short and smooth, and of a bright reddish colour; whilst in winter the hair thickens and hardens, and the colour deepens, especially on the upper part. The roebuck is pretty generally distributed, being found in all the temperate parts of Europe and Asia, and even, it is said, in India. The roebuck was formerly very common in Wales, the north of England, and in Scotland, but at present the species no longer exists in any part of Great Britain except in the Scottish Highlands, where they are not met with in exactly the same places as the red deer, but rather where there is an admixture of hill and rock and copse. The roebuck does not keep in herds, but only congregates in families in the lower coverts and less wild woods. The male is monogamous, and remains attached to one female for life, the two keeping company, or at least being near to each other, all the year round; and the rutting season is not accompanied with that violent excitement which takes place in the others, more especially in the stag. Rutting time is in the beginning of November, and the female goes little more than five months, while the fallow-deer goes eight months, and the hind a little more. The pairing is thus about two months later than the others, and the fawns are dropped about two weeks earlier. The female produces two fawns at a birth, and these she conceals from the male. They are said to live twelve or fifteen years, and to be able to reproduce the species at the age of eighteen months. Herbage and tender shoots of underwood are the food of the roebuck in summer, and in winter, when the ground is covered with snow, it feeds on the tender branches of the fir and the birch. As it prefers the tender twigs and buds of young trees to grass, it is very destructive to young plantations. The male sheds his horns soon after the rutting season, and acquires the new ones during the winter, so that he is in his apparel for a much longer period of the year than the hart or the fallow-buck.

ROE-STONE, *ro'-stone*.—A name sometimes given to those lime-stones which are composed of small rounded grains like the roe of fishes. Oolite is the scientific term. (*See* OOLITE.)

ROLLER, *role'-er*.—The name given to a genus of birds (*Coracias*) which belong, according to some naturalists, to the *Meropidæ* (Bee-eating family), and by others to the *Corvidæ* (Crow family). The characteristics are:—bill somewhat large, straight, compressed towards the point, upper mandible curved downwards; wings, long; plumage generally very brilliant; legs short and strong. There are several species, well diffused over the warmer parts of the Old World, especially abundant in the north of Africa, the Mediterranean islands, and in some parts of Asia. One species only, the Common Roller (*Coracias garrula*), is found in Europe, and seldom in Britain. The name is derived from its habit of rolling or tumbling in the air like a tumbler pigeon. It has also a habit of tossing its food in the air and catching it in its wide open beak, swallowing it when it falls in a proper direction for entering the throat.

ROMAN ALUM. (*See* ROCH ALUM.)

ROOK, *rook* (Sax., *hroc*).—This well-known gregarious and familiar bird (*Corvus frugilegus*), which is to the inhabitants of well-cultivated countries the most interesting of the whole family of the *Corvidæ*, is spread over the greater part of Europe, but is nowhere more abundant than in Great Britain and Ireland. Wooded and cultivated districts are its favourite haunts. There are few in the more northern parts of Scotland, none in Orkney and Shetland, and they do not appear to be numerous either in Denmark, the southern districts of Sweden, in Russia, or Northern Asia. In Italy it is common and permanent, and abounds in France; but it appears to be migratory over a part of the continent of Europe. The rook is about twenty inches long, and forty in the stretch of the wings. It is distinguished from the raven and the crow by having a bill of an entirely different character from theirs, it being nearly straight, and having much less of the predatory character. Its bill is bluish-black, with a portion of the skin at the base bare of feathers in the full-grown birds, and covered with a scaly scurf of a whitish colour; but in the young birds this portion is covered with feathers, which are projected a little way over the base of the bill. The whole of the plumage is black, but glossed with reflections of purple, violet, and blue, which are very rich and beautiful when the bird is in good condition. The legs and claws are also generally of a black colour. Specimens are sometimes, but rarely, met with which are white, piebald, or yellowish. Every spring the rooks resort to breed on the same trees, preferring the loftier branches, and building sometimes ten or twelve nests, which are one above another on the same tree, whilst a great many trees thus furnished, occur in the same forest, or rather in the same district, and form what is called a rookery. As soon as rooks have finished their nest, and before they lay, the males begin to feed the females, and continue to do so through the whole season of incubation. The stick-built nest contains four or five pale greenish eggs, blotched with dark-greenish-brown. Both the male and female are very assiduous in feeding their young, and the skin under the tongue may, at this season, be often seen dilated into a kind of pouch by the collected food. Grain and insects especially form the food of the rook, and it repays the farmer for the seed by the assiduity with which it clears his land of wireworms and the larvæ of the cock-chafer.

ROOT, *root* (Dan., *roed*).—In Botany, the descending axis, or that portion of the axis of the plant which passes at its first development in an opposite direction to the stem or ascending axis. The extension of this organ is effected by the addition of new matter, not at its base, or point of junction with the stem, but at that portion which adjoins the apex. Roots are usually subterranean; but some merely float in water, and others hang loosely in the air. They have no leaves, and generally no buds, and they appear to divide and subdivide irregularly, unlike stems, which always ramify in a symmetrical manner. There are two classes of roots—the *primary* or *true*, and the *secondary* or *adventitious*. The primary root is produced by the direct elongation of the radicle. The part where the stem and primary root unite is termed the *collum*, or *neck*; the portion of the latter organ adjoining this is called the *base*, and the opposite extremity the *apex*. The secondary root does not proceed from any definite point, and its development may be said to depend upon favourable external circumstances. The branches from a primary root, and the roots produced from the different modifications of the stem—as the rhizome, the sucker, and the runner—are all of the secondary class. (*See* ADVENTITIOUS and AERIAL ROOTS.) According to the duration of their existence, all roots have been divided into *annual*, *biennial*, and *perennial*. Annual roots are produced by those plants which spring from seed, flower, and die in the space of one year; as the oat and the balsam. Biennial roots are those of plants which live two years; as the carrot and the turnip. Perennial roots are those of plants which live for many years: in some such plants, as the dahlia and orchis, the roots are the only perennial portions, the stems dying every year. The root assumes various forms, which are distinguished by special terms in descriptive botany. When the central axis of a plant goes deep into the ground without dividing, a *tap-root* is produced; the root of the common stock illustrates this generic form. If instead of descending in a direct line the tap-root takes a crooked course, it is said to be *contorted*, or *twisted*, as in the bistort; if it ends abruptly, as though bitten off, it is termed a *truncated* or *præmorse* root, as exemplified in the devil's-bit scabious. The *conical* root may be described as a tap-root, rather broad at the base, and tapering towards the apex: the roots of the horseradish, parsnip, and carrot are familiar examples. The *fusiform* or *spindle-shaped* root is another variety of the tap-root. It swells out a little below the base, and tapers upwards and downwards: it is seen in the common radish. The *napiform* or *turnip-shaped* root has a globular form, being much swollen at the base: the common turnip is its type. When the descending axis is very short, and at once divides into slender branches or rootlets, a *fibrous* root is produced, as in many of the grasses. When the branches are short and fleshy, as in the dahlia, the root is said to be *fasciculated*, and when some of the divisions are so swollen as to become egg-shaped, as in many orchids, and especially in the jalap-plant, the root is *tuberculated*. To roots which expand only at certain points, the terms *nodulose*, *annulated*, and *necklace-shaped*, have been applied. A few other forms have received separate names, but they are unimportant.

ROOT-MILDEW.—A species of decay which sometimes affects the roots of trees and causes their death. Properly speaking it is a sort of fungus which thus attacks them, certain *mycelia* supposed to belong to the species of *Polyporus* (which *see*). The roots are found covered with numerous white films. If this decay is feared, and the state of the bark above the soil is seen to give evidence of it, it may be stopped by washing with corrosive sublimate in solution.

ROOT PARASITES.—Plants, such as the Broom-rapes, which grow upon the roots of the plants and draw their nourishment from them. (*See* OROBANCHACEÆ.)

ROOT-STOCK, also called Rhizome. (*See* RHIZOME, ROOT.)

RORQUAL, *ror'-kwal*.—A genus of large whales (*Rorqualus*), belonging to the same family as the Greenland Whale (*Balænidæ*), but characterized by having a pointed dorsal fin and the bone of the upper jaw nearly straight. There are several species, all of them very large. Probably the rorquals are the largest animals now to be found alive in the world, the Northern Rorqual being sometimes over 100 feet long. Another species is found in the South Seas. (*See* CETACEA, WHALE.)

ROSA, *ro'-za* (Gr., *rhodon*, a rose).—In Botany, the Rose, a genus of the natural order *Rosaceæ*. The species and varieties are well known for the beauty and fragrance of their flowers. They are shrubs, ranging from 1 foot to 6 or 8 feet in height. The flowers in the wild species are usually single, but in the cultivated varieties semi-double or double. The colours are red, white, purple, and rarely yellow, in numberless shades and mixtures. Botanists are not agreed as to the number of original species of rosa; formerly all the European roses were supposed to have a common origin, but they are now generally regarded as the descendants of numerous distinct species. *R. gallica*, a native of the south of Europe, is the species from which the greater number of garden varieties have been developed, particularly those with dark red and purple petals. *R. damascena*, the damask rose, a native of the Levant, is another prolific species, having given the florist some lovely blush, white, and red roses. The so-called monthly roses, the earliest to flower, are varieties of this species. The British species *R. spinosissima*, or Scotch rose, is the source of numerous choice double roses, blush, red, marbled, white, and yellow. *R. Centifolia*, the hundred-leaved Provence, or cabbage rose, a native of the south of Europe, is known under from fifty to sixty varieties, of which the beautiful moss-rose is an especial favourite. *R. indica*, the Chinese rose, *R. semperflorens*, the ever-blooming rose, and other species from China, have also yielded beautiful varieties under the hand of the florist. In the culture of roses, much use is now made of the Dutch invention of forming standards, by budding on hardy woody stocks of the dog rose, *R. canina*, or the tree rose, *R. villosa*. The standards are budded at different distances from the ground, according to taste and the purposes in view, and form, after a few years, handsome round heads, which flower freely and preserve the variety a longer time than in plants raised from cuttings or layers. They are particularly valuable for shrubberies and lawns, where the culture of the root required by dwarf roses could not be given, and, if omitted, would occasion the degeneracy of the variety. New varieties of the rose are obtained from seed; but the usual mode of propagation is by layers. All will grow by cuttings, and some, as *R. sempervirens*, freely; but this mode is seldom resorted to. For preserving delicate varieties, the best plan is decidedly that of budding on hardier sorts. Most species of the rose in the wild state grow in sandy and rather poor soil, except such as are confined to woods, where the soil is comparatively rich and moist; but all cultivated roses, and especially the double-flowered kinds, require a rich loamy soil, inclining to clay rather than sand. The species *R. rubiginosa*, or sweet-brier, so remarkable for its sweet-scented foliage, is a native of Britain. The dog rose, or brier, *R. canina*, is the commonest British species, being found in hedges and thickets in most parts of England, Ireland, and Scotland. The fruits commonly called hips are employed in medicine for their refrigerant and astringent properties. The dried petals of the unexpanded flowers of *R. gallica* constitute the red rose-leaves of the shops; they are used medicinally as mild astringents and tonics. Rose-water is prepared by distilling the fresh petals of *R. centifolia* with water, to which a little spirit of wine has been added. The mode of obtaining the fragrant volatile oil of roses is described in an early part of this work. (*See* ATTAR OF ROSES.)

ROSACEÆ, *ro-zai'-se-e*.—In Botany, the Rose family, a natural order of *Dicotyledones*, sub-class *Calycifloræ*, having the following essential characters:—Trees, shrubs, or herbs with alternate leaves and regular flowers. Calyx 4—5-lobed, when 5, the odd lobe posterior; petals 5 or none; stamens perigynous, distinct; anthers 2-celled; carpels 1 or more, usually distinct, or sometimes united, generally superior, or occasionally more or less inferior; seeds 1 or few, exalbuminous; embryo straight.

Sub-Orders.—Professor Bently divides the order into five sub-orders as follows:—

Sub-order 1, *Chrysobalaneæ*.—Trees or shrubs, with simple leaves and free stipules. Carpel solitary, cohering more or less on one side with the calyx: ovules 2, erect; style basilar. Fruit a drupe. Seed erect. Example: *Chrysobalanus*.

Sub-order 2, *Amygdaleæ* or *Drupaceæ*.—Trees or shrubs, with simple leaves and free stipules. Calyx deciduous. Carpel solitary, not adhering to the calyx; style terminal. Fruit a drupe. Seed suspended. Examples: *Amygdalus*, *Prunus*, *Cerasus*.

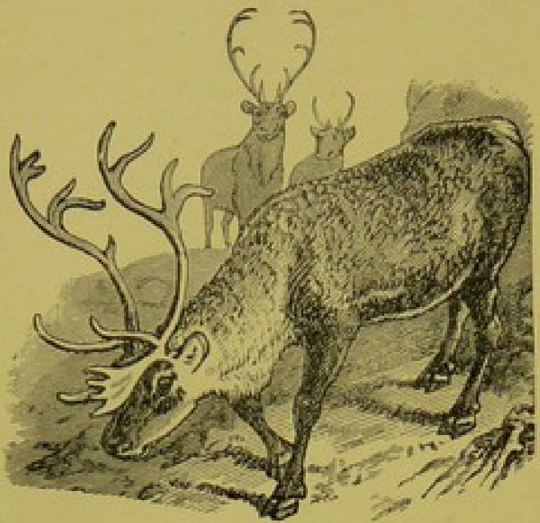
Sub-order 3, *Roseæ*.—Shrubs or herbs, with simple or compound leaves, and adherent stipules. Carpels 1 or more, superior, not united to the tube of the calyx, distinct or sometimes more or less coherent; styles lateral or nearly terminal. Fruit either an etærio, or consisting of several follicles. Seed usually suspended, or rarely ascending. Examples: *Rosa*, *Rubus*, *Fragaria*.

Sub-order 4, *Sanguisorbeæ*.—Herbs or undershrubs. Flowers often unisexual. Petals frequently absent. Carpel solitary; style terminal or lateral. Fruit an achænium enclosed in the tube of the calyx, which is often indurated. Seed solitary, suspended or ascending. Example: *Alchemilla*.

Sub-order 5, *Pomeæ*.—Trees or shrubs with simple or compound leaves and free stipules. Carpels 1 to 5, adhering more or less to each other and to the sides of the calyx, and thus becoming inferior; styles terminal. Fruit a pome, 1—5-celled, or rarely spuriously 10-celled. Seeds ascending. Examples: *Cydonia*, *Pyrus*, *Cratægus*.

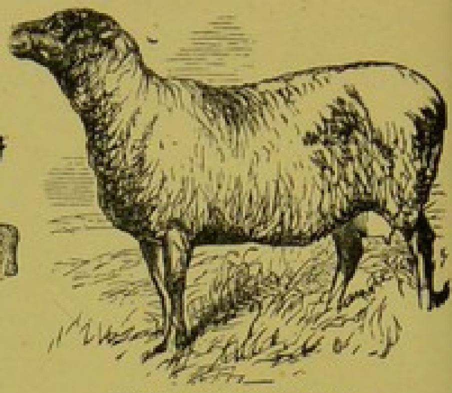
By some botanists the above sub-orders are considered to be distinct natural orders. The order *Rosaceæ* comprises about 90 genera and 1,000 species, of which about one half belong to the sub-order *Roseæ*. The *Chrysobalaneæ* are principally natives of the tropical districts of America and Africa. The *Amygdaleæ* and *Pomeæ* are confined to the cold and temperate regions of the northern hemisphere. The *Roseæ* and *Sanguisorbeæ* are chiefly natives of cold and temperate climates though a few flourish within the tropics. The plants of the order are remarkable for their astringent properties, and for their succulent edible fruits (peaches, plums, cherries, raspberries, strawberries, apples, pears, &c.). The seeds, flowers, leaves, and young shoots of many of the *Amygdaleæ* and *Pomeæ*, when moistened with water, yield hydrocyanic acid; hence the part of such plants are sometimes poisonous. All other *Rosaceæ* are entirely devoid of poisonous properties.

ROSANILINE, *roze-an'-e-leen*.—An alkaloid



REINDEER.

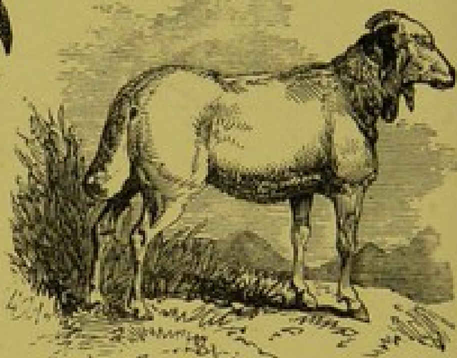
SARSAPARILLA.



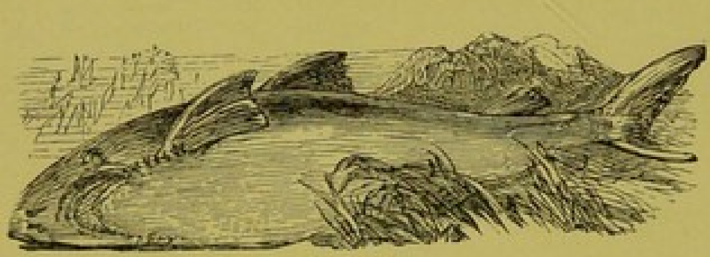
SHEEP, SOUTHDOWN EWE.

STARLING.

SAGE.



SHEEP, FAT-TAILED.



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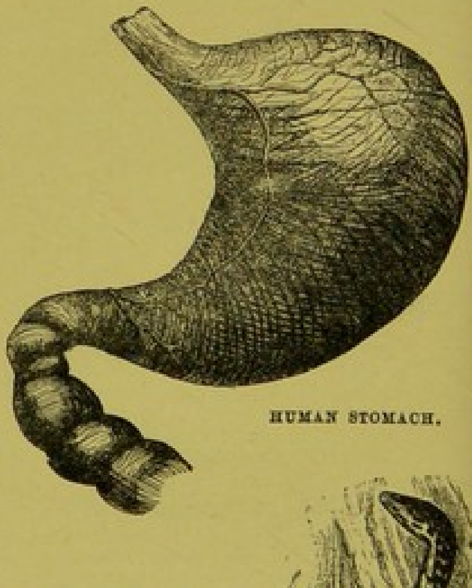


HUMAN STOMACH.

SQUIRREL, FLYING.

ROCK SNAKE.

derived from aniline by the action of certain ordinary agents upon that body. Rosaniline is the base of the magnificent crimson dye known as "magenta," and is generally manufactured commercially by acting on crude aniline with dry arsenious acid. The salt used in dyeing is the acetate, which is the most soluble of them all. The alkaloid itself is colourless, but the slightest touch of the weakest acid is sufficient to produce the brilliant crimson now so well known. The salts of rosaniline are all remarkable for the facility and beauty with which they crystallize, the acetate especially forming magnificent crystals, which exhibit, by reflected light, the splendid green and gold metallic lustre seen on the wings of the rose-beetle. All the salts, when crystallized, exhibit a similar appearance. Rosaniline has been chemically examined with great care by Dr. Hoffmann, who states its formula to be $C_{20}H_{19}N_3$.

ROSE. (*See* ROSA, ROSACEÆ.)

ROSE, THE.—A common name for Erysipelas (which *see*).

ROSE-APPLES. (*See* EUGENIA.)

ROSE-BEETLE.—A common coleopterous insect (*Cetonia aurata*) about three-quarters of an inch in length, and of a bright green, and sometimes copperplate colour, with two white irregular fasciæ towards the latter part of the elytra, and extending from the side inwards. It feeds upon rotten timber when in its larva state, and is frequently found in ants' nests, where it seems to feed on the pieces of wood of which they are composed. As a perfect insect, it is seen very commonly in the south of England flying about in the sunshine in the months of May and June, frequently settling on roses, the leaves of which it greedily devours.

ROSEMARY. (*See* ROSMARINUS.)

ROSE OF JERICHO. (*See* ANASTATICA.)

ROSETTA STONE, *ro-zet'-ta* (so called from Rozetta, a village of Egypt, where it was discovered).—Is the name of a celebrated stone found by the French in Egypt in 1799. On the capitulation of Alexandria, it came into the hands of the British, and was brought to England in 1802, being now in the British Museum. It is of black basalt, and the surface is about three feet in length, by about two and a half in breadth; but it is much mutilated. It contains three (or rather parts of three) distinct inscriptions—in hieroglyphic characters, in enchorial, or the characters of the country, and in Greek, and is celebrated for the light which it has thrown on the ancient heiroglyphics, by affording a comparison with the Greek. Unfortunately, however, the Greek only gives the substance of the inscriptions, and the hieroglyphical portion is much mutilated. It appears to have been erected by Ptolemy Epiphanes (B.C. 193), and narrates his deeds, his piety, liberalities, victories, &c. (*See* HEIROGLYPHICS.)

ROSEWOOD. (*See* TRIPTOLOMÆA.)

ROSMARINUS, *roz-ma-ri'-nus* (Lat., *ros*, dew; *marinus*, bordering on the sea).—In Botany, the Rosemary, a genus of the natural order *Labiatæ*. *R. officinalis*, the common rosemary, is a well-known herb, formerly much used in domestic medicine as a remedy for the headache. It was supposed to have the power of strengthening the memory; hence the allusion of the poet: "There's rosemary, that's for remembrance." The flowery tops contain a volatile oil, which imparts to them stimulative and carminative properties. These are, however, seldom used medicinally at the present time, but are largely employed in perfumery. The flavour of Narbonne honey is said to be due to the bees feeding on the flowers of this plant. The dried leaves are occasionally used by country folk as a substitute for China tea. Rosmarinus is so called because, growing on the shore, it is said to appear early in the morning like dew.

ROT, DRY. (*See* DRY ROT.)

ROTATION OF THE EARTH.—The motion of the earth around its own axis, is called its rotation; while its motion around the sun is usually spoken of as its revolution round the sun. (*See* EARTH.)

ROTATORIA, *ro-ta-to'-re-a* (Lat., *rota*, a wheel).—A family of the *Infusoria*, which has the mouth surrounded by a corona of vibratile hairs, which represent a kind of wheel. (*See* ROTIFERA.)

ROTIFERA, *ro-tif'-er-a* (Lat., *rota*, a wheel; *fero*, I bear).—Wheel-animalcules, a class of animals placed by Ehrenberg among the *Infusoria*, under the name *Rotatoria*. They have acquired these names on account of the apparent rotation of the wheel-like organs which surround their mouths, and which are covered by cilia. They are extremely minute, but some of the larger forms can be seen with the naked eye. Their existence, however, was first discovered by Leeuwenhoek. He first gave a description of their structure and habits in the "Philosophical Transactions" for 1702. The Rotifera are very widely diffused on the surface of the earth. They inhabit both salt and fresh waters, and are found in the cold, temperate, and tropical parts of the earth. Although capable of swimming freely, they are generally found near or attached to the leaves of plants. They have no true circulating or respiratory organs, though in most of the species minute vessels can be seen which terminate in blind sacs or cæca.

ROTTLERA, *rot-le'-ra* (after Dr. Rottler, a Danish missionary).—In Botany, a genus of the natural order *Euphorbiaceæ*. The fruit of *R. tinctoria* is covered by a red powder, which has long been employed as a dye for silk: it produces, with suitable mordants, a beautiful orange or flame-colour. It is found in the Indian bazaars under the name of *kamala*, and is known at Aden by the names *waras* or *wurrus*. Kamala is also used medicinally in India as an anthelmintic, and as a remedy for cutaneous diseases.

ROXBURGHIACEÆ, *roks-bur-ge-ai'-se-e*.—In Botany, the *Roxburghia* family, a natural order of *Monocotyledones*, sub-class *Dictyogenæ*. Twining shrubs, with tuberous roots; broad, leathery, net-veined leaves; and large showy flowers. The order includes but one genus, *Roxburghia*, of which there are four species, all natives of the hotter parts of the East Indies.

RUBASSE, *ru-bas'*.—A sort of rock-crystal internally filled with small spangles of specular iron which reflect a bright ruby light. An artificial rubasse is made by heating pure rock-crystal very hot, and plunging it repeatedly into a coloured liquid. The real rubasse is much prized for ornamental purposes.

RUBEFACIENTS, *ru-be-fai'-she-ants* (Lat., *rubecatio*, I make red).—In Medicine, is a name given to certain substances which, when applied to or rubbed upon the skin, cause redness. The simplest is the compound camphor liniment; hartshorn and oil is also often used, though perhaps best of all is the common mustard poultice. Oil of turpentine, corrosive sublimate, and iodine, are still more powerful; some skill is required in applying them, and unless properly used they may give rise to severe inflammation.

RUBEOLA. (*See* MEASLES.)

RUBIA, *ru'-be-a* (Lat., *ruber*, red).—In Botany, a genus of the natural order *Galiaceæ*. The species *R. tinctorum* is extensively cultivated in France, Holland, and the Levant for the sake of its root, which constitutes the important dye-stuff madder. The entire roots are imported from the Levant, and called Turkey roots; the French madders are found in commerce in a state of very fine powder, packed in large casks. In the living state, madder-root contains only a yellow colouring principle, but no less than five distinct colouring matters, called respectively madder purple, red, orange, yellow, and brown. The first two, which have received the chemical names *purpurin* and *alizarin*, are by far the most important. Besides being used as a dye-stuff, madder has long been employed in medicine as a tonic and diuretic, and has been regarded as a valuable emmenagogue. The roots of *R. cordifolia* or *munjista*, a native of India, are employed for dyeing in Bengal, and are occasionally imported into this country under the name of *munjeet*. The roots of *R. Relboun* are similarly employed in Chili.

RUBIDIUM, *ru-bid'-i-um*.—An alkaline metal discovered in 1860 by Bunsen, by means of spectrum analysis. It is very rare, and occurs only in small quantities. It so closely resembles potassium, that even chemical re-agents or the blow-pipe will not distinguish it from that metal. Symbol, Rb. Atomic weight 84·5, sp. gr. 1·52. Its name is from *rubidus*, dark red, because two red lines are present in its spectrum. In 1861 another metal, *cæsium*, very similar to rubidium, was also discovered by Bunsen. (*See* CÆSIUM.)

RUBY, *ru'-be* (Fr., *rubis*).—This term is applied popularly to two distinct minerals—the pyrope and the spinelle ruby, both of which are much valued as gems. The pyrope is a silicate of magnesia and alumina, with varying admixtures of iron, chromium, manganese, and lime. It occurs chiefly at Zöblitz, in Saxony; at Mittelgebirge, in Bohemia; and at Elie, in Fifeshire. The *spinelle ruby* and its varieties, the orange-red *rubicelle*, and the violet or brown *almandine*, are aluminates of magnesia, with different proportions of iron and chromium. They mostly occur in Ceylon, at Ava, and in other parts of the East Indies.

RUBUS, *ru'-bus* (Lat., *ruber*, red).—In Botany, a Bramble, a genus of the natural order *Rosaceæ*. Several species yield edible fruits. *R. Idæus* is the raspberry plant, a native of these isles, greatly improved by cultivation. Raspberries are either red or amber-coloured, and have an agreeable sub-acid taste; they are much used for preserves and tarts, either alone or mixed with currants. *R. fruticosus* produces the blackberries which children seek with such eagerness in hedges and thickets; *R. cæsius* yields the dewberry; *R. chamæmorus*, the cloudberry. All these fruits are examples of the *etærio* (which *see*). The root of *R. villosus* is much employed as an astringent in some parts of the American continent.

RUE. (*See* RUTA.)

RUFF, *ruf*.—A bird (*Machetes pugnax*) belonging to the family *Scolopacidæ*, and found in marshy places in England and Ireland. It is larger than the snipe, being about a foot in length, having a short pointed tail and long pointed wing; the legs also are long and slender. In the breeding season the neck of the male is surrounded with a *ruff* of long feathers—hence the name. The female of this bird is called the Reeve. The plumage of the male is remarkable for its diversity of colours, no two birds being exactly alike: ash-brown, spotted with black, prevails, however; while the head and neck has also a purple gloss, with chestnut spots. The colours of the Reeve are much more uniform, as a rule, being ash-brown, spotted with dark brown.

RUFFE, OR POPE.—A little fish (*Acerina cernua*) belonging to the Perch family. (*See* PERCH.)

RULE OF EQUATIONS. (*See* EQUATIONS.)

RUM, *rum*.—A spirit distilled from the sugar-cane, that is, from cane-juice, or the scummings of the juice from the boiling-house, or from the treacle or molasses, or from *dunder*—the lees of former distillations. The following is the process employed in Jamaica:—Equal parts of scummings, dunder, and water having been mixed together, fermentation soon begins; and in twenty-four hours the liquor is fit for the first charge of molasses, which is added in the proportion of three gallons for every hundred gallons of the liquor. Another charge is added in a day or two, or afterwards. The heat in fermentation should not exceed 90° or 94°. The fermentation falls in six or eight days, and the liquor grows fine and fit for distillation. In about two hours after lighting the fire, the spirit begins to run (in a still of 1,200 gallons), and it is collected as long as it is inflammable. The first spirit is called low wines, and it is rectified in a smaller still to the Jamaica proof, which is that in which olive-oil will sink. The proportion of molasses made in crystallizing a cwt. of sugar varies from fifty to ninety gallons, and depends both upon the climate and the season, being lowest in the Leeward Islands, which have a dry climate, and highest in Demerara and Trinidad. Nearly one gallon of proof rum may be made from one gallon of molasses.

RUMEX, *ru'-meks*.—In Botany, a genus of the natural order *Polygonaceæ*, including the different kinds of sorrel and dock. Several species possess acid properties, owing to the presence of oxalic acid, especially *R. acetosa*, the common sorrel, *R. acetosella*, *R. scutatus*, and *R. patientia*. They have been employed as pot-herbs and for salads. In France the first species is largely cultivated, a sauce made from it being a regular addition to many dishes. It is sometimes used medicinally for its refrigerant, diuretic, and antiscorbutic properties. The root of *R. hydrolapathum*, the great water-dock, is astringent and antiscorbutic; that of *R. alpinus* is purgative, and was formerly used as a substitute for rhubarb, under the name of monk's rhubarb.

RUMINANTS, *ru'-me-nantz* (Lat., *ruminantia*).—The name given by Cuvier to his eighth order of *mammifères*, indicating the singular faculty possessed by the animals belonging to it of masticating a second time their food, which they return into the mouth after a previous deglutition—a power which is the result of the structure of their stomachs, of which they always have four. The animals belonging to this order have nearly all the air of being constructed on the same model, the camels alone presenting some small exceptions to the common character. The first of these characters, according to Cuvier, is the possession of incisor teeth in the lower jaw only, these being nearly always eight in number, and replaced above by a callous rim. Between the incisors and the molars is a wide space, where are found, in one or two genera only, one or two canines. The molars, nearly always six in number, on each side of the upper and lower jaws, have their crown marked with two double crescents, the convexity of which is turned inwards in the upper and outwards in the lower teeth. The four feet are terminated by two toes and two hoofs, which oppose to each other a flattened surface, so that they have the appearance of a single hoof which has been split. The first stomach is much the largest in the adult animal, but not so in the recently-born calf or lamb. It is divided outwards into two bag-like appendages at its extremity, and it is slightly separated into four parts on the inside. The internal coat of the stomach is beset with innumerable flattened papillæ. It is very capacious, and fitted to receive a large quantity of grass or other matter on which the animal feeds; but no gastric fluid, or any other solvent fluid, enters it, and thus it is simply a receptacle. From this stomach the herbage, rudely broken up by the first mastication, is transferred to the second stomach, or "kingshood," which is of a very peculiar construction. It is very muscular in its walls, and the interior of it consists of cells, which are larger or smaller, according to the size of the animal and the nature of the food upon which it habitually subsists. The walls of these cells have the faculty of standing erect, at the same time that there is a vermiform or twisting motion of the entire organ. By means of these cells and this motion the food is compressed into small balls, which are one by one returned to the mouth for remastication. During this operation, the animal remains in a state of repose, until all the herbage swallowed has undergone the action of the molar teeth a second time. The aliment thus remasticated is passed into the third stomach, or "manyfold;" so called because it consists of parallel laminæ, bearing some resemblance to the leaves of a book, which lie lengthwise and vary in breadth, in regular alternate order, amounting to some forty in the sheep and about a hundred in the cow. This is the stomach in which the drink of the animal mingles with its food. From the manyfold, the food and drink combines, and are reduced to a pulp, upon which the real digestive process can be exercised, are conveyed to the fourth, or truly digestive stomach of the animal, which is the only one that secretes gastric juice, and is commonly known by the name of "the red." It is next in size to the first stomach or paunch, of an elongated pyriform shape, and with an internal villous coat, similar to that of the human stomach, with large longitudinal wrinkles. Cuvier makes ruminants consist of two divisions; first, those without horns, and second, those with horns. The first division embraces the camels, the llamas, and the chevrotains. Secondly, all the rest of the ruminants, of the male sex at least, have two horns or prominences, more or less long, projecting from the frontal bones.

RUM SHRUB.—The name of a liquor, the basis of which is rum, and the other materials sugar, lime, or lemon; each maker seems to have his own recipe.

RUNNER, *run'-ner.*—In Botany, a long thin branch proceeding from a plant without a stem, as, for instance, the strawberry.

RUNNERS, SCARLET. (*See* PHASEOLUS.)

RUPTURE. (*See* HERNIA.)

RUPIA, *ru'-pi-ah.*—The name of a somewhat severe skin disease, characterized by flat bullæ or blebs, filled with serous or purulent fluid, which in a short time thickens and dries into brown scabs. In severe cases, known as *Rupia prominens*, the scab projects forward like a limpet shell. The treatment consists in the administration of tonics such as quinine, and in the local treatment of puncturing the blebs as they arise, removing the scabs by poultices, and applying solution of nitrate of silver to the subjacent ulcers. The diet must be good. The tincture of serpentaria is recommended by some prescribers, as is also iodine of potassium.

RUSA, *ru'-sa.*—The name given to a genus of deer, natives of the East Indian forests, and having the antlers round. There are several species, the *Sambur* or *Samboo* (*Rusa Aristotelis*) being the largest and finest. It is found in India and much sought after by sportsmen. The Great Rusa (*Rusa Hippelaphus*) is a native of Java, Sumatra, &c., and the neck has a large mane. (*See* DEER.)

RUSCUS, *rus'-kus.*—In Botany, a genus of the natural order *Liliaceæ*. The species *R. aculeatus*, commonly called butcher's-broom, has aperient and diuretic roots, which were formerly much employed medicinally in visceral diseases. The roasted seeds have been used as a substitute for coffee.

RUSHES. (*See* JUNCACEÆ.)

RUSH-NUT. (*See* CYPERACEÆ.)

RUST, *rust* (Sax.)—A general term applied to the yellowish coat of peroxide which forms on the surface of iron exposed to a moist atmosphere. To prevent the rusting of iron utensils, oil, paint, varnish, plumbago, grease, or any substance which will protect the metal from the moist air, may be employed. Under all ordinary circumstances, iron decomposes water, abstracts the oxygen, and combines with it; thus forming rust.

RUTA, *ru'-ta.*—In Botany, a genus of the natural order *Rutaceæ*. *R. graveolens* is the common rue, a native of Europe. It has a very powerful, disagreeable, peculiar odour, which is due to the presence of a volatile oil. Its taste is bitter and nauseous. It is used in medicine as an antispasmodic, anthelmintic, emmenagogue, stimulant, and carminative. This plant is supposed to be identical with the *peganon* of the New Testament (Luke xi. 42). The species *R.*

montana possesses very acrid properties. (*See* RATACEÆ.)

RUTA BAGA. (*See* TURNIP.)

RUTACEÆ, *ru-tai'-se-e.*—In Botany, the Rue family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*, distinguished by the following essential characters:—Herbs, shrubs, or trees, with exstipulate dotted leaves and perfect flowers. Calyx and corolla with a quaternary or quinary distribution of their parts, the former with an imbricated æstivation, the latter twisted or valvate, and sometimes wanting; stamens equal in number, or twice or thrice as many as the petals, rarely fewer (by abortion), inserted on the outside of a hypogynous disc; ovary of from 2—5 carpels, separate or combined, either sessile or elevated upon a stalk; ovules sessile. Fruit capsular; embryo with a superior radicle; albumen present or absent. The Rutaceæ have been divided into two sub-orders, as follows:—

Sub-order 1, Rutaceæ.—Seeds containing albumen; fruit with sarcocarp and endocarp combined. Example: *Ruta*. The plants of this sub-order are chiefly found in the southern part of the temperate zone.

Sub-order 2, Diosmeæ.—Seeds exalbuminous; fruit having the sarcocarp separate from the endocarp when ripe. Example: *Barosma*.

These genera abound at the Cape of Good Hope; other genera are found in Australia, and others in equinoctial Africa. The plants of the order are generally characterized by a powerful odour and a bitter taste. Several are employed medicinally. (*See* GALIPEA, BAROSMA, RUTA.)

RUTHENIUM, *ru-then'-i-um.*—A metal of little use, discovered by Claus in 1843 in platinum ore. In most things it closely resembles iridium. Its symbol is Ru. Equivalent 104 (old system 52), and specific gravity 11·3.

RYE. (*See* SECALE.)

RYE-GRASS, *ri'-grass.*—A genus of grasses (*Lolium*), of which there are several species, the commonest being the Common or Perennial Rye-Grass—the Ray-Grass of the old English authors. This grass is very frequent on the way-sides and fields of Britain, and also on the Continent. It is used for forage and hay. Another variety, the Italian Rye-Grass, was introduced from the south of Europe in 1831, and in certain soils it succeeds remarkably well, being very luxuriant in early spring.

S.

SABADILLA, *sa-bad-il'-la.*—A Mexican plant (*Asagræa officinalis*) of the natural order *Melanthaceæ*. (*See* ASAGRÆA.)

SABBATIA, *sab-bai'-she-a*, (after Sabbatia, an Italian botanist).—In Botany, a genus of the natural order *Gentianaceæ*. The herb and root of the species *S. angularis* are employed medicinally in North America for their tonic and febrifugal properties. The plant is commonly known as an American centaury.

SABIACEÆ, *sab-e-ai'-se-e.*—In Botany, a small natural order of *Dicotyledones*, sub-class *Calycifloræ*, containing but two genera, which were formerly placed among the *Anacardiaceæ*, but which differ from the latter in their stamens being opposite to the petals, in their distinct carpels, and in other characters. They are natives of India.

SABICU, *sab-i'-kew.*—A tree, native of Cuba (*Acacia formosa*), the wood of which is very close-grained and remarkably tough and hard. It was used to construct the stairs at the great exhibition in Hyde Park in 1851, and exhibited but little sign of wear after several months' hard use. Its colour is of a dull red.

SABLE, *say'-ble.*—A little animal (*Martes zibellina*), very closely allied to the Marten. (*See* MARTEN.) Its chief characteristic is its very beautiful and lustrous fur, which is so highly prized, that a skin ranges in value from £6; a very fine one being worth even £15 or £16.

SABOTS, *sa-bots'.*—A kind of wooden shoes in great use by the Belgian and French peasantry.

SACCHARIC ACID, *sak'-kar-ik.*—A colourless gummy mass, $C_6 H_{10} O_8$, produced by the action of nitric acid on grape and cane sugar or on gum, lignine and starch. It is soluble in alcohol.

SACCHAROMETER, *sak-ka-rom'-e-ter* (Lat., *saccharum*, sugar; Gr., *metron*, a measure).—A variety of hydrometer used in the process of brewing, in order to ascertain the density of the liquid extracted from malt. The same instrument is used to indicate the degree to which the juice expressed from the sugar-cane is concentrated previously to undergoing the process of crystallization. (For a description of the instrument, *see* HYDROMETER.)

SACCHARUM, *sak'-ka-rum* (Lat.).—In Botany, the sugar cane, a genus of the Grasses, natural order *Graminaceæ*. *S. officinarum*, the common sugar-cane, is a native probably of India, the Indian Islands, or of China; it is now extensively cultivated in the East and West Indies, and in the warmer regions of the American continent. It flourishes best where the mean temperature is from 75° to 77° Fahr.; but it thrives where the mean temperature does not exceed 66° to 68° Fahr.; hence it is grown far beyond the tropics. The plant attains the height of from six to twelve feet, and has a jointed stem, hard and dense externally, but juicy in the inside. It is cultivated from cuttings, and takes about a year to come to maturity. It is then cut down close to the earth, topped, stripped of its leaves, and crushed between heavy iron rollers in a mill. The juice is first mixed with lime to saturate the acid which is present, and then heated. The clear liquor is separated, and evaporated till it becomes granular. It is then put into casks, and the uncrystallizable part (molasses, or golden syrup) having drained off, the sugar is left in the state of the raw sugar of commerce. The quantity of molasses is diminished, and that of the sugar increased, by evaporating the juice at a lower temperature *in vacuo*. Sugar undergoes purification in various ways: by solution in water, refining with albuminous matter, filtration through animal charcoal, evaporation and re-crystallization. When white and pure, it forms refined or loaf-sugar. The uncrystallizable portion formed in the process of refining constitutes treacle. The total quantity of sugar annually extracted from the sugar-cane over the whole globe has been estimated at 4,527 millions of pounds.

SACRUM, OR OS SACRUM, *os sai'-krum* (Lat., sacred bone, so called probably from being offered in sacrifices by the ancients).—In Anatomy, is the bone which forms the basis of the vertebral column, being articulated above by the last lumber vertebræ, while laterally it is firmly united by a broad irregular surface to the ossa innominata or hip-bones, and united below to the os coccygis. In young subjects, it is composed of five or six pieces, united by cartilage, but in more advanced age it becomes one bone, in which, however, we may still easily distinguish the marks of the former separation. It is pyramidal in form, flattened before and behind, with its basis towards the lumber vertebræ and its point terminating in the coccyx. Like the vertebræ, it presents various processes, and holes affording passage for the nerves.

SAFETY-LAMP, *saif'-te.*—A lamp used by miners, and so constructed as to reduce greatly the risk of an explosion. The dangerous accumulation of fire-damp in some mines renders this necessary. The contrivance of a steel mill was long known, and it afforded a tolerable gleam of light. It consisted of a small frame of iron, mounted with a wheel and pinion, which gave rapid rotation to a steel disc placed upright, to the edge of which a piece of flint was applied. The attention of the scientific was more particularly called to the subject when an appalling colliery explosion occurred at the Felling colliery, in Durham, in 1812; ninety-two lives were then instantaneously destroyed. The first safety-lamp was that of Dr. Clauny, of Sunderland. It consisted of an air-tight lamp with a glass front, the flame of which was supported by blowing fresh air from a small pair of bellows through a stratum of water in the bottom of the lamp, while the heated air passed out through water by a recurved tube at the top; by this means the air within the lamp was completely insulated from the surrounding atmosphere. Various other schemes for safety-lamps were brought forward, but they were all superseded by the invention of Sir Humphry Davy, founded on his fine researches into the nature of flame. This lamp consists of a common oil-lamp surmounted by a covered cylinder of wire gauze. Davy had ascertained that the explosions of inflammable gases were incapable of being passed through long narrow metallic tubes, and that this principle of security was still obtained by diminishing their length and diameter at the same time. Ultimately, this fact led him to trials upon sieves made of wire gauze, or metallic plates bored with numerous small holes, and he found that it was impossible to pass explosions through them. About the same time George Stephenson, with that peculiar aptitude for mechanical design which always distinguished him, and without any knowledge of the researches of the chemist, devised a lamp by which air was admitted to the flame through "apertures of wire gauze." Hence among the pitmen in the north of England at the present time safety-lamps are distinguished as either "Davies" or "Geordies."

SAFETY-VALVE. (*See* STEAM-ENGINE.)

SAFFLOWER. (*See* CARTHAMUS.)

SAFFRON. (*See* CROCUS.)

SAGAPENUM, *sag-a-pe'-num* (Gr.).—A fœtid gum-resin, imported into Europe from the Levant, and also from Alexandria, in amygdaloidal masses of a brownish-yellow or olive colour, sometimes in tears. It is probably a Persian product, and has been supposed to be obtained from the root of the umbelliferous plant *Ferula persica.* It is employed medicinally as an antispasmodic, but it is considered to be less powerful than asafœtida. It is included in the Materia Medica of the London Pharmacopœia.

SAGE. (*See* SALVIA.)

SAGITTARIA, *saj-it-tai'-re-a* (Lat., *sagitta*, an arrow).—The arrow-head, an indigenous, aquatic, perennial herb, flowering in July or August (*Sagittaria sagittifolia*). Its root is tuberous, nearly globular, with many long fibres. In China it is much cultivated for its esculent properties, its mealy nature making it easily convertible into starch or flour. The floating leaves are very variable in size, and in form resemble the head of an arrow, from which circumstance the plant derives its name. The leaves also are very cooling when applied to the skin; they have consequently been used, and may be serviceable, as a dressing to inflamed sores. Arrow-head, as a food, is much relished by most cattle.

SAGITTARIUS, *saj-it-tai'-re-us* (Lat., the archer).—A name given in Astronomy to one of the signs of the zodiac, situated below Aquila, between Scorpio and Capricornus. Its figure is that of a centaur drawing a bow: this constellation must not be confounded with Centaurus. The mythological account of Sagittarius is very meagre. According to some, the constellation represents the centaur Chiron, and according to others, Crocus, whom the Muses requested after death to be placed among the signs.

SAGOUIN, *sa-goo'-in.*—A genus of small American monkeys, sometimes called Squirrel Monkeys. They have small rounded heads, large ears, short muzzle, and a long but not prehensile tail; the body is covered with beautiful fur.

SAGUERUS, *sag-u-e'-rus* (from *sagu*, the Malay name of various palms).—In Botany, a genus of Palms. *Sag. saccharifer* is the Gommuti palm, which supplies the greater part of the sugar produced in the Moluccas and Philippines. Palm sugar, called *jaggery* in India, is generally obtained from the juice which flows out from the different palms upon wounding their spathes and surrounding parts. The saccharine juice of the Gommuti palm is transformed into an intoxicating liquor or toddy by fermentation. This is termed *neva* in Sumatra, and a kind of arrack is distilled from it in Batavia. From the trunk of this palm, when exhausted of its saccharine juice, a good deal of our commercial sago is obtained, a single tree yielding from 150 to 200 lbs. The juice of the fruit is very acrid. Besides sugar, toddy, and sago, this palm yields the stiff, strong fibre known in commerce as *Gommuti* or *Ejow fibre.*

SAGUS, *sai'-gus* (Malay, *sagu*).—In Botany, a genus of Palms. From the trunk of *S. lævis*, *S. genuina*, and other species, the principal part of our sago is obtained. (*See* SAGO.)

SAHI, *say-hi.*—The common alcoholic drink of Japan, &c., is a sort of beer, made from rice.

SAHI.—The name given to a genus of American monkeys (*Pithecia*), also called Fox-tailed monkeys, because their tails are covered with long hair. (*See* MONKEY.)

SAIGA. (*See* ANTELOPE.)

SAIN FOIN, OR SAINTFOIN, *sayn'-foin.*—In Botany, a spreading perennial plant (*Onobrychis sativa*), belonging to the sub-order *Papilionaceæ*, natural order *Leguminosæ*. It has spikes of flesh-coloured flowers streaked with red; pods one-seeded, marked with wrinkles, and leaves of 9—15 smooth leaflet. It grows well on calcareous soils, but can scarcely be cultivated on any other. It affords the best fodder for cattle, sheep, or horses.

SAINT ANTHONY'S FIRE. (*See* ERYSIPELAS.)

SAINT IGNATIUS'S BEANS. (*See* IGNATIA, STRYCHNINE.)

SAINT JOHN'S BREAD. (*See* CERATONIA.)

SAINT JOHN'S WORT. (*See* HYPERICACEÆ.)

SAL, *sal.*—In Chemistry this word was formerly used as a prefix to signify a crystallizable compound; as, for example, *sal-ammoniac*, or chloride of ammonium; *sal-enixum*, acid sulphate of potash; *sal-prunella*, fused nitrate of potash; *sal-acetosellæ*, oxalate of potash; *sal-volatile*, carbonate of ammonia, or liquid ammonia; *sal gem*, or rock salt.

SAL.—In Botany, the name of one of the most valuable timber trees of India. It belongs to the natural order *Dipteraceæ*.

SALAMANDER, *sal-a-man'-der* (Lat.).—Any description of the few harmless reptiles which belong to the family *Salamandridæ* would be incomplete if no notice were taken of the ignorant superstitions which made them the "daughters of fire," and gave them the faculty of poisoning vegetables. It is difficult to trace the manner in which these superstitions arose; but their origin, doubtless, had some relation to the extraordinary metamorphoses which salamanders undergo. The salamanders are a genus of batrachian reptiles, having some slight resemblance to the lizards in their external shape, but very properly separated from them by more modern naturalists, since their structure came to be better understood. The general characters may be described as follows:—The body lengthened, with four feet of equal dimensions, and a long tail; the head is flat, and the ear entirely embedded in the flesh, and without any distinct tympanum, and only a small cartilaginous plate on the opening; both jaws are furnished with numerous small teeth, and there are two parallel rows of such teeth along the bones in the upper part of the mouth, which represent the vomer; the ribs are merely rudimental, though they are not wholly wanting as in the frogs; but there is no sternum or bone; the sternum is very imperfectly developed, and suspended to the spine by ligaments; the legs are of nearly equal length, and without any webs on the toes or claws of them; and there are always four toes on the fore feet, and, generally speaking, five on the hind ones. In the adult state they breathe in the same manner as tortoises and frogs, but in their early state they breathe in the water by means of gills. Salamanders are, technically speaking, ovoviviparous; that is, when the ova or eggs have arrived at the state in which, in the other batrachia, they are wont to be expelled, in these they are retained for some time after their development. A peculiar property of the salamander is, that when repeatedly deprived of an important portion of their body, that portion is as frequently renewed. An eye, for instance, may be extracted, and speedily a new and perfect one is found to have supplied its place. Salamanders are usually divided into land species and water species; but it must be observed that the land ones inhabit humid places and the aquatic ones breathe air, and are not wholly confined to the water.

SAL-AMMONIAC. (*See* AMMONIA, CHLORIDE OF.)

SALEP. (*See* EULOPHIA and ORCHIS.)

SALICACEÆ, *sal-e-kai'-se-e* (Lat., *salix*, the willow).—In Botany the Willow family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*. Trees or shrubs, chiefly natives of cold and temperate climates. Leaves simple, alternate, stipulate. Flowers unisexual, amentaceous, naked, or with a membranous or cup-like calyx. Male flowers with 1—30 distinct or Monadelphous stamens; female flowers with a superior 1-celled, ovary; ovules numerous, erect. Fruit 1-celled, 2-valved. Seeds numerous, covered with long silky hairs, exalbuminous; embryo erect, with an inferior radicle. Many of the species are valuable for their timber, and some for their tonic and febrifugal bark. The hair investing their seeds has been employed for stuffing cushions. There are but two genera—*Salix* and *Populus* (which *see*), and about 250 species.

SALICIN, *sal'-i-sin.*—In Chemistry, a neutral bitter principle found in the bark of willows. It is procured by adding to an aqueous infusion of the bark hydrated oxide of lead, by which the tannin and colouring matters are precipitated. Salicin has been made the subject of a series of interesting and valuable researches by Piria of Turin, which have thrown considerable light on the compounds known as glucosides. Mixed with synaptase (a peculiar ferment), it splits up into glucose and saleginin. Heated with bichromate of potash and sulphuric acid distilled, a fragrant oily liquid comes over, which has exactly the same physical and chemical characteristics as the essential oil of meadow-sweet.

SALICORNIA, *sal-e-kor'-ne-a.*—In Botany, a genus of the natural order *Chenopodiaceæ*. The species were formerly much used in making *barilla* (which *see*).

SALIVA, *sa-li'-va* (Lat., from *sal*, salt).—Is that fluid by which the mouth and tongue are constantly moistened in their natural state, and which is supplied by glands which form it, called the salivary glands. There are three pairs of salivary glands—the parotid, the sub-maxillary, and the sublingual. The saliva itself has neither colour nor smell, and is tasteless; for although it contains a little salt, the nerves of the tongue are so accustomed to it that it is imperceptible. Its specific gravity is somewhat greater than that of water, and it is supposed that about twelve pounds are secreted in twelve hours. From the mechanical pressure of the muscles upon the salivary glands, the secretion is much augmented during speaking and mastication. In hungry persons, too, it is largely secreted at the sight of agreeable food. Its uses are to augment the taste of food by the evolution of sapid matter, to mix with, dissolve, and resolve into its principles, the food during mastication, so as to change it into a pultaceous mass fit to be swallowed; to moderate thirst, by moistening the cavity of the mouth and fauces. In the healthy state, it consists of at least four-fifths of water, comprising, besides, mucilage, ptyalin, albumin, muriate of soda, phosphate of soda, phosphate of lime, and phosphate of ammonia.

SALIVATION, or PTYALISM, *sal-e-vai'-shun, ti'-al-izm* (Gr., *ptualizo*, I spit frequently).—In Medicine, denotes an increased and involuntary flow of the saliva. This may be caused in a variety of ways. It may be occasioned by strong mental emotions, by the use of certain medicines, and it is also symptomatic of various diseases of the mouth and neighbouring parts; as in dentition, scarlatina, small-pox, &c. Mercury is by far the most common agent in the production of salivation. The quantity required to produce salivation differs in different persons, and consequently its effects require to be watched to prevent excessive action. It acts whether used externally or internally, and generally after a short time, and even with a small quantity. At first, the mouth feels uncommonly hot, with a coppery or metallic taste; the flow of saliva is much increased, the breath becomes fœtid, the gums red and tender, and at length the whole mouth, tongue, and throat become sore and swollen; and ulcers and sloughs quickly form on the mucous membrane. In the treatment of mercurial salivation, a nutritive diet, pure air, and mild purgatives are required. Cold is to be particularly guarded against, as well as the other extreme of heat. Gargles of chlorate of soda or lime are useful in cleansing the mouth and correcting the fœtor of the breath. If the constitutional irritation is excessive, opiates require to be administered, and the best for this purpose is Dover's powder in small doses.

SALIX, *sal'-iks* (Lat.).—In Botany, the Willow, a genus of the natural order *Salicaceæ*. The species found in Great Britain are commonly known as willows, osiers, and sallows. Their timber, though wanting in strength and durability, is applied to many useful purposes; it is well adapted for the manufacture of charcoal. The wood of the flexible branches and twigs is largely employed for basket-work, hoops, &c. A peculiar crystalline alkaloid, resembling quinine in its properties, called salicine, has been obtained from the bark, leaves, or flowers of about twenty species of this genus.

SALMON, *sam'-on* (Lat., *salmo*; Fr., *saumon*).—A celebrated fish (*Salmo Salar*), belonging to the family of the *Salmonidæ*, the generic characters of which are as follows: Head smooth; body covered with scales; two dorsal fins, the first supported by rays, the second fleshy, without rays; teeth on the vomer, both palatine bones, and all maxillary bones; branchiostegous rays varying in number, generally from ten to twelve, but sometimes unequal on the two sides of the head of the same fish. The general length of the salmon is from two and a half to three feet, but sometimes much more. The male is principally distinguished by the curvature of the jaws; both the lower and upper mandible bending towards each other more or less in different individuals and at different seasons. The general colour of both sexes is a silvery gray, of a much darker cast on the back; the sides of the male are marked with numerous small, irregular, dusky, and copper-coloured spots; while those of the female exhibit only several rather large, distant, roundish, or somewhat lunated spots, of a dark colour. Besides these differences, the male is of a somewhat longer or more slender shape than the female. The scales in the salmon are middle-sized, and not very strongly adherent. The salmon is a fish of great elegance, combining a form fitted alike for strength and swiftness, and occupies a foremost place in the estimation of both sportsman and epicure; its pink-coloured flesh being regarded by the latter as a great delicacy, in spite of its being somewhat indigestible.

Habits and Natural History of the Salmon.—The salmon inhabits the seas around Great Britain, and extends to the north of Europe and Asia. It enters the rivers sooner or later in the spring or summer months to spawn, but generally delays entering them until the streams become somewhat swollen by rains. When this has occurred, they enter them usually in large bodies, swimming in the middle of the stream, and near the surface, and seldom resting in their course as long as the water remains discoloured. In the first part of their course, they are easily frightened either by a sudden noise or floating timber, and on such occasions frequently turn aside and return to the sea. When further advanced, however, they make the most determined efforts to surmount rapids and cascades, and will leap a fall of twelve or fifteen feet in perpendicular height. If they fail in their attempt and fall back into the stream, it is only to remain a short time quiescent, and thus recruit their strength to enable them to make new efforts. The fish having at length gained the upper and shallow pools of the river, preparatory to the important operation of depositing the spawn in the gravelly beds, its colour will be found to have undergone considerable alteration during the residence in fresh water. As the process of milting and roeing advances, extreme pressure appears to injure the vital functions; the animal oil and all interstitial matter are absorbed, and the fish becomes thence lean in flesh, and what remains is not only in a great measure colourless and insipid, but frequently unwholesome also. The male becomes marked on the cheeks with orange-coloured stripes: the lower jaw elongates, a cartilaginous projection turning upwards from the point; the body receives a golden-orange tinge, and the fish in this state is called a *red fish*. The female seems to suffer even more than the male, and as it turns dark in colour, is frequently termed a black fish. The manner in which salmon deposit their spawn is as follows. A pair of fish make a furrow by working up the gravel with their noses, rather against the stream, as a salmon cannot work with his head down stream; for the water then going into his gills the wrong way drowns him. When the furrow is made, the male and female retire to a little distance, one to the one side, and the other to the other side of the furrow; they then throw themselves on their sides, again come together, and rubbing against each other, both shed their spawn into the furrow at the same time. This process is not completed at once; it requires from eight to twelve days for them to deposit all their spawn; and when they have done, they betake themselves to the pools to recruit themselves. They finally redescend to the sea by easy stages, where their former condition and silvery lustre are soon regained, and their strength invigorated. The ova continue covered by the gravel during the winter, and begin to vivify from about the end of March, to the commencement of April. The fry remove from under the gravel when about an inch in length, with the ovum still attached, the head and eyes large, and the colour of the body pale brown, with nine or ten dusky gray marks across the sides. The young salmon fry, or parr, as it is called as long as it retains the brown marks on its sides, may remain a whole year in the fresh water. On the eve of descending to the sea, it assumes a more brilliant dress, and becomes a smolt. At this time it is from four to six inches in length, of a greenish-gray above, silvery below, the scales extremely delicate and very deciduous. From the time the smolts reach the sea, for two months or ten weeks we lose sight of them, and can only infer their growth from the fact, that after the lapse of that period we find them again ascending the rivers, with a weight of from two and a half to four pounds. They are then known under the name of *gilse* or *grilse;* and their size, as they ascend from the sea, increases with the advance of the season. The grilse, which thus ascend, spawn during the ensuing winter, and are then entitled to the name of salmon. Descending in a weak state, they return in the following summer some ten or fifteen pounds in weight. The size of grilse or salmon does not depend on age, but on capacity for growth, or the length of time they remain at sea, and on the quantity and quality of food they find there. There are rivers in which salmon never attain the weight of ten pounds; others in which grilse are often of that weight, and salmon of the weight of fifty pounds. That the food sought for to produce and sustain the rapid growth in size of the young salmon must be very considerable in quantity as well as most nutritious in quality, cannot be doubted; whilst the fact that the salmon is a voracious feeder, may equally be inferred from the degree of perfection in the arrangement of its teeth, and from its own habits; and yet, strange to say, of the many observers who have examined the stomach of a salmon to ascertain the exact nature of that food which must constitute their principal support, few have been able to satisfy themselves. At sea they are taken with small fish and sand-eels within them; but in our rivers they are seldom observed to have anything within their stomachs but mucus, a peculiarity which probably arises from their having, like herrings, a very quick digestion, and from their taking in their food in very small quantities at a time, and thus leaving the stomach in a constant state of capacity or fitness for immediate digestion.

The Regulation of Salmon-Fisheries.—During many centuries, in this country, this has been the subject of much controversy, legislation, and litigation. It forms a prominent clause in Magna Charta; was legislated for by Edward I. of England and by Robert the Bruce of Scotland; has never since been allowed to rest, and during the last fifty years has been stirred up almost perpetually by commissions, committees, or bills; and has almost perpetually been before the law courts in one shape or another. It is, in fact, a very valuable fish, fetching a considerably higher price, pound for pound, than any kind of butcher's meat; and, as it consumes nothing of value to men, is, to use Franklin's phrase, a bit of silver pulled out of the water. In former times salmon were very plentiful both in Scotland and England; they were in large request, as salted fish, for the religious houses during the winter; and in Rymer's *Fœdera* we have an order given by Edward II. to provide 3,000 dried salmon for the sustenance of his men. But in recent times the supply has much decreased, from the increase of land drainage, the fouling of the water from manufactories, the killing of spawning fish, over-fishing, and the brevity of the close season. In 1861, the laws relating to salmon fisheries were consolidated, and in 1863 an act restricting the taking of salmon at certain times was passed. This act was amended in 1869-70, and it is unlawful to catch fish of the salmon kind between 14th September and the 1st February.

SALSAFY. (*See* TRAGOPOGON.)

SALSOLA, *sal-so'-la* (Lat., *sal*, salt; *solus*, alone; from its saline qualities).—In Botany, a genus of plants belonging to the natural order *Chenopodiaceæ.* The species inhabit salt-marshes, and contain much soda. (*See* BARILLA.)

SALT (COMMON).—Salt (*chloride of sodium*) is one of the most important British minerals, and is procured in immense quantities, both from fossil beds and brine-springs, in Cheshire and Worcestershire. A rocky bed is the source of nearly all our inland salt; but as subterranean streams flow over this bed and become saturated with salt, the original form is changed, and it is simply a question of manufacturing convenience whether to raise the common salt and purify it, or to raise the liquid brine and operate upon that. Previously to the discovery of the fossil beds in the 16th century, and subsequently, a good deal of salt continued to be made by the evaporation of sea-water in salt-pans, at Lymington and other places; but the works at these places are now all but abandoned. It is estimated that about a million and a half tons of salt are manufactured in Cheshire, Worcestershire, and Ireland annually, of which quantity about half (chiefly that manufactured in Cheshire) is exported. There was formerly a duty on salt, which originated as a war tax in the ninth year of William III., and was not removed till the year 1823, and raised the price of salt from 6d. a bushel to more than 20s. The brine-springs, so abundant in the great plain of the red marl and sandstones of Cheshire, occur at various depths, in some places being within ten or twelve yards of the surface, and at others from fifty-five to sixty. They were worked there as early as the time of Edward the Confessor. The strata passed through in sinking for either brine or rock salt are usually clay or gypsum, mingled in various proportions, the latter predominating in nearing the brine or rock salt. The rock salt of Cheshire is found in considerable masses, differing in form and purity. These are separated by blasting and with the aid of the usual tools. The purer rock is called Prussia rock, from its being largely exported to the shores of the Baltic. The cavity formed in working a salt-bed, when lighted by candles, presents a brilliant and striking appearance. There are vast deposits of rock salt at Bochina and Vieliczka, in Galicia, and others equally important along each side of the great Carpathian range, extending at various intervals from Moldavia to Suabia. Salt is the only mineral food of man, and forms an essential constituent of the blood, the loss of saline particles therefrom by the secretions, the tears, the bile, &c., being repaired by the use of common salt as a condiment. Salted-provisions are unwholesome; but this is almost certainly due rather to their hardness and indigestibility than to the salt with which they are impregnated. All animals appear to be more or less fond of salt, and even bees will sip a solution of it with avidity. (*See* SODIUM.)

Salterns.—In countries situated near the sea-coast, common salt is frequently obtained by the evaporation of sea-water, in which it is usually found at about two per cent. In the preparation of salt from sea-water, the water is exposed in a series of shallow pools, called salt-gardens or salterns, to the action of the sun and air. The salterns are laid out on a clay soil on the sea-coast, and are protected from the influence of the tides. They are worked during the warmer months, from March to September. The repeal of the duty on salt enabled the Cheshire manufacturers to sell the article at so low a rate that the proprietors of salterns could not compete with them, and they can now only flourish in countries which have no natural deposits of salt or brine, and where foreign salt is excluded by a high protective duty.

SALTPETRE. (*See* POTASH, NITRATE OF.)

SALTS.—In Chemistry, a salt may be defined as a compound containing either a metallic oxide or alkaloid in combination with an acid or a metal, or pseudo-metallic grouping in combination with a halogen. The advocates of Gerhardt's theory reverse his well-known definition of an acid—namely, "a salt whose basis is hydrogen"—and describe a salt as any metallic compound that is obtainable from an acid by the substitution of a metal or psuedo-metallic grouping for hydrogen. When first Lavoisier proposed his admirable scheme of chemistry, it was supposed than an acid could not exist without containing oxygen. As the science advanced, Sir Humphrey Davy discovered the true composition of hydrochloric acid, and found that there were acids whose acidifying principle was hydrogren, which, when entering into combination with metallic oxides, gave up their hydrogen to the oxygen to form water. Taking the union of hydrochloric acid and soda as an example, it was found that the chlorine united directly with the sodium, the water formed at the time being readily driven off by heat. To meet this difficulty, salts were divided into two classes—oxy-salts, formed by the union of a base and an acid, and haloid salts, formed by the union of a metallic and a halogen. Sir Humphry Davy advanced a theory, however, which is now almost universally received as the correct one. He assumed that when acids were rendered anhydrous they lost their acid properties, an assumption provable by direct experiment. Sulphuric acid he looked on not as SO_3, the anhydrous acid, but as $HOSO_3$, or rather HSO_4. This at once brought the two classes of salts into harmony, the grouping SO_4 being equivalent to the halogen in HCl, HI, HBr, &c. This theory is accepted in its entirety by the advocates of the new school. Salts being looked on as the union of an acid radicle with a metal, the name in a few cases has been necessarily altered. Thus, we now constantly meet with carbonate of *potassium*, nitrate of *sodium*, sulphate of *ammonium*, &c., in chemical publications.

Salts are generally divided into three classes:—*Basic salts*, in which the amount of base predominates over the acid; *neutral salts*, when these are united, equivalent for equivalent in protosalts, or one of base to three of acid in sesquisalts; and *acid salts*, where the acid is in excess. These terms must be taken in their chemical sense, and not as meaning the effect that certain salts have on litmus or turmeric paper. Thus, carbonate of potash, which is chemically a neutral salt, reddens turmeric paper, and sulphate of alumina, also neutral, reddens litmus. Numerous examples of each of these classes will be found throughout this work. *Double salts* are those whose acid apparently combines with two bases to form a crystalline compound; but the real union appears to take place between the two salts. Thus we have the double chloride of platinum and potassium, KCl $PtCl_2$; the double sulphate of potash and alumina, or ordinary alum, $KOSO_3$, $Al_2O_33SO_3$; the double sulphate of potash and magnesia, $KOSO_3$, $MgOSO_3$, &c.

SALVADORACEÆ, *sal-va-do-rai'-se-e.*—In Botany, the *Salvadora* family, a small natural order of *Dicotyledones*, sub-class *Corolliflorœ*, consisting of shrubs and small trees, with leathery leaves and minute panicled flowers. The species are natives of India, Syria, and North Africa. The only one of any importance is *Salvadora persica*, which Dr. Royle has shown to be the mustard-tree of Scripture. Its fruit is edible, and resembles in taste the garden cress. The bark of its root is acrid, and is employed in India as a blistering agent. Its leaves are said to possess purgative properties.

SALVIA, *sal'-ve-a* (Lat., *salvus*, well, in good health, because it was esteemed capable of curing many diseases).—A genus of the natural order *Labiatœ*, consisting of herbs and under-shrubs, with aromatic leaves, which have generally a rugose appearance, and flowers commonly in spikes. The species best known is *S. Officinalis*, the common or garden sage, so much used by the cook as a flavouring agent, particularly in the stuffing for pork, goose, and duck. An infusion of sage was formerly used, under the name of *sage-tea*, as a substitute for that of China tea; it is still largely employed in North America as a gargle in common sore-throat and when the uvula is relaxed. Many of the *salvias* are very ornamental plants, and are favourite objects of culture with the florist.

SAMARA, *sam'-a-ra* (Lat., the seed of the elder tree).—In Botany, a superior two or more celled fruit, each cell being dry, indehiscent, few-seeded, and having its pericarp extended into a winged expansion. Each cell of the Samara is, in fact, an achænium, with a winged margin. Examples of the Samara occur in the so-called sycamore, the ash, and the elm.

SAMBUCUS, *sam-bu'-kus* (Lat., a musical instrument formed of this tree).—In Botany, the Elder, a genus of the natural order *Caprifoliaceœ*. *S. nigra* is the common elder, well known on account of its fruit, from which the elder-wine of old-fashioned folk is manufactured, a liquor which is now chiefly used for adulterating port wine. Several parts of this plant are used in medicine. Its flowers contain a volatile oil, which renders them mildly stimulant and sudorific; they are employed in the preparation of a cooling ointment, and to make elder-flower water. The inner bark and leaves have more or less purgative and emetic properties. The fruit is mildly aperient and diuretic.

SAMPHIRE. (*See* CRITHMUM.)

SAMYDACEÆ, *sam-e-dai'-se-e.*—In Botany, a natural order of *Dicotyledones*, sub-class *Monochlamydeœ*, consisting of trees and shrubs, exclusively tropical and principally American. Leaves alternate, simple, evergreen, stipulate, usually with round or linear transparent markings. Flowers perfect. Calyx inferior, 4—5-partite. Stamens perigynous, two, three, or four times as many as the segments of the calyx. Fruit superior, capsular, leathery, 1-celled. Seeds numerous, arillate, with oily or fleshy albumen and large embryo. The plants are of little economic value.

SAND, *sand* (Sax.).—Both common, river, and sea sands are composed of finely-divided silicious matter; particles of other substances are mixed with it, and sometimes it becomes calcareous through the presence of carbonate of lime. Pure silicious sands are very valuable for the manufacture of glass, for ameliorating dense clay soils, for moulding, and many other purposes.

SANDAL-WOOD. (*See* SANTALUM.)

SAND EEL. (*See* LAUNCE.)

SANDPIPER, *sand-py'-per.*—The popular name for a group of birds, generally referred to the family *Scolopacidœ*, and now divided into the genera *Totanus*, *Pelidna*, and *Actitis*. They have many characteristics in common, their plumage being sombre rather than gay, their bill long and slender, legs and wings rather long, and good swimmers.

SANDSTONE, *sand'-stone.*—A general term applied in Geology to all stones composed of agglutinated grains of sand, which may be silicious or calcareous.

SANGUINARIA, *sang-gwin-ai'-re-a* (Lat., *sanguis*, blood, because used to stop hemorrhage).—In Botany, a genus of the natural order *Papaveraceæ*. The most interesting species is *S. canadensis*, the puccoon, a native of North America. Its root, often called blood-root, from its containing a red juice, is used internally in large doses as an emetic and purgative, and in small doses as a diaphoretic and expectorant. When applied externally, it is said to exhibit marked escharotic properties, and has been tried combined with chloride of zinc as an application to check cancerous growths. Its efficacy as an external application has been doubted by those who have employed it in this country.

SANGUISORBEÆ, *sang'-gwis-sor-be-e.*—In Botany, a sub-order of the rose order. (*See* ROSACEÆ.)

SANGUISAGA. (*See* LEECH.)

SANITARY SCIENCE, *san'-e-ta-re* (Lat., *sanitas*, health).—That department of human knowledge which regards the laws of the human body, and of the agents by which it is surrounded, with a view to the preservation of health and the warding off of disease and death. The practical application of these laws constitutes Hygiene, or the art of preventing disease. This is commonly divided into public and private hygiene, the former having regard to the healthy condition of persons in communities, in camps, barracks, work-houses, &c.; the latter to the health of individuals. Even as early as the time of Moses, we find numerous stringent sanitary laws and regulations laid down and enforced among the ancient Jews. The Greeks and Romans also had various regulations and provisions for the preservation of health and the prevention of disease; but among modern nations little was done till very recent times in this matter. It was not till 1831, when the cholera visited this country, that the public mind became awakened to the importance of paying greater attention to the laws of health; and it was not till 1845 that the "Nuisances' Removal Act" was passed, which became permanent in 1848. By 11 & 12 Vict. c. 63 (called the Public Health Act, 1848), amended and continued by subsequent acts, a "General Board of Health" was constituted, the members of which were a president, appointed during her Majesty's pleasure, the principal secretaries of state for the time being, and the president and vice-president for the time being of the Board of Trade, with power to appoint for its assistance a medical council and a medical officer. Provision was also made for the establishment of local boards of health, having power to appoint officers, and charged with a variety of duties relating to the removal of nuisances; control over streets, water and gas works; the regulation of slaughter-houses, common lodging-houses, &c.; the construction of sewers, drains, privies, and other matters of a like nature. After ten years of successful operation, the Public Health Act was repealed in 1858, and the General Board of Health abolished, and a new Public Health Act passed, which placed the power formerly exercised by the General Board of Health in the hands of the Privy Council. In 1855, the Diseases' Prevention Act and the Nuisances' Removal Act were passed. By means of these and similar enactments, a variety of causes of disease are brought within the operation of the law, the local authorities being empowered to give notice for the removal of any nuisance, and if not attended to, a summons can be issued, and the offending parties brought before a magistrate. By the recent Vaccination Extension Act, all persons are required to have their children vaccinated within three months of their birth, under a penalty of £10 for neglect. Public hygiene has for its object a particular knowledge of all the circumstances affecting the health of a community, and the application of rules and remedies to the many unwholesome influences that spring out of a social existence. It takes cognizance of the geographical position of towns, the arrangement of streets, the situation and construction of houses (warming, lighting, &c.), the cleansing of the public way (draining, sewering, &c.), supply of pure water, offensive and injurious trades, burial of the dead, disinfectants, and antiseptics. It also concerns itself with the adulterations of food, the origin and spread of epidemics, the specific and general causes of endemic diseases, &c. (*See* PUBLIC HEALTH ACT.)

SANSEVIERA, *san-se-ve-e'-ra* (in honour of M. Sansevier, a Swedish botanist).—In Botany, a genus of the natural order *Liliaceæ*. *S. zeylanica*, and other species, have strong and tough fibres which constitute the African hemp or bow-string hemp of commerce.

SANTA-FÉ TEA. (*See* SYMPLOCOS.)

SANTALACEÆ, *san-ta-lai'-se-e* (Arab., *zandal*).—In Botany, the Sandal-wood family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*. Herbs, shrubs, or trees, with entire alternate leaves, and flowers usually perfect. Calyx superior; 4—5-cleft, valvate in æstivation. Stamens perigynous, equal in number, and opposite the segments of the calyx. Ovary 1-celled, inferior; ovules 1—4, usually suspended; placentation free-central. Fruit indehiscent, 1-seeded. Seed with a quantity of fleshy albumen; embryo straight, minute; radicle superior. The Santalaceæ are natives of various parts of the world. Those of North America and Europe are inconspicuous herbs; while those of India and Australia are trees or shrubs. The genus *Thesium* is parasitic on the roots of other plants. Some of the plants are remarkable for their fragrant wood: a few produce edible seeds. (*See* SANTALUM and FUSANUS.)

SANTALIN, OR SANTALIC ACID, *san'-tal-in.*—The colouring matter of red sandal-wood. It is obtained by heating raspings of the wood in alcohol at a high temperature (*see* DIGESTER), and then precipitating the santalin by adding water.

SANTALUM, *san'-ta-lum* (Arab., *zandal*).—In Botany, the typical genus of the natural order *Santalaceæ*. The fragrant wood called sandal-wood is obtained from *S. album*, a native of India. It is employed in perfumery, and is used by the Indian doctors as a sedative and refrigerant. *S. Freycinatium* and *paniculatum* furnish the sandal-wood of the Sandwich islands.

SANTONIN, *san'-ton in.*—The vegetable principle of the seeds-flower-heads of the plants Artemisia (which *see*).

SAP.—In Botany, the nutrient fluid which circulates in plants. As it rises to the stem it is of a watery nature, and contains the various inorganic matters absorbed by the roots, also some sugar, dextrine, and other organic substances which it has dissolved in its upward course. In its passage to the leaves it becomes more and more altered from the state in which it was absorbed by the roots; but when it reaches the leaves it is still unfitted for the requirements of the plant, and is hence termed *crude* sap. Through the action of the light and air, it undergoes important changes in the leaves and other green parts, and becomes adapted for the nourishment of the plant. In this state it is termed *elaborated* sap. In *Dicotyledones*, this elaborated fluid descends through the internal bark and cambium layer towards the root, and is transmitted laterally inwards by the medullary rays. (*See* BOTANY.)

SAPACAYAN NUTS. (*See* LECYTHIS.)

SAPAJOUS, *sap'-a-jooz.*—A name given to those American monkeys which have prehensile tails. (*See* MONKEY.)

SAP-GREEN. (*See* RHAMNUS.)

SAPINDACEÆ, *sap-in-dai'-se-e* (from Lat., *sapo Indicus*, Indian soap).—In Botany, the soapwort family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*, consisting of large trees and climbing shrubs, with the following essential characters:—Flowers unsymmetrical, hypogynous. Sepals and petals 4—5, imbricated, the latter commonly with an appendage. Stamens never agreeing in number with the sepals and petals, and inserted on a fleshy or glandular disc, or upon the thalamus; anthers bursting longitudinally. Fruit usually consisting of 3 carpels. Seeds commonly 2, sometimes 1 or 3, or very rarely more, exalbuminous, usually arillate and without wings; embryo almost always curved or spirally twisted. The plants of this order flourish chiefly in tropical regions, especially in South America and India. There are no European species—the well-known horse-chestnut having been introduced into Europe from Asia and America. The presence of a saponaceous principle is one of the most prominent properties of the order. Many of these plants are poisonous in all their parts; but it more frequently happens that, while the roots, leaves, and branches are dangerous, the succulent fruits are innocuous, or in some cases even valuable articles of dessert. The useful products of the order are timber, edible fruits, starch, and the soapy matter above referred to. (*See* ÆSCULUS, NEPHELIUM, PAULLINIA, SAPINDUS.)

SAPINDUS, *sap-in'-dus* (from Lat., *sapo Indicus*, Indian soap).—In Botany, a genus of the natural order *Sapindaceæ*. The most important species is *S. saponaria*, the fruits of which are employed in the West Indies instead of soap for cleansing linen. The fruits of *S. inæqualis* contain the same saponaceous principle, and are used for the same purpose.

SAPODILLA PLUM, *sap-o-dil'-la.*—The fruit of the *Achras Sapota*; much esteemed in the West Indies. (*See* ACHRAS.)

SAPONARIA. (*See* CARYOPHYLLACEÆ.)

SAPONIFICATION, *sa-pon-e-fe-kai'-shun*, (Lat., *sapo*, soap).—The term applied to the separation of the fatty acids from their glyceric base, by the addition of an alkali or other metallic base, which unites with them. (*See* SOAP.)

SAPONIN, *sap'-o-nin* (Lat., *sapo*, soap).—A substance resembling soap, contained in a large number of plants, such as the *Saponaria officinalis*, in the root of the common pink, and in the fruit of the horse-chestnut. It is easily extracted from these sources by boiling alcohol. It is soluble in water in all proportions, and froths strongly on agitation. The juice of soapwort is often used as a detergent for cleansing the finer varieties of wool from grease. Powdered, it forms a powerful sternutatory. Boiled with dilute acids, it forms saponic acid.

SAPOTACEÆ, *sap-o-tai'-se-e.*—In Botany, the *Sapota* or *Sapodilla* family, a natural order of *Dicotyledones*, sub-class *Corollifloræ*. Trees or shrubs, often having a milky juice, with alternate, simple, exstipulate, coriaceous leaves and hermaphrodite flowers. Calyx usually with 5 divisions, sometimes 4—8; corolla with as many divisions, or twice or thrice as many; stamens definite, in a single row, half of them sterile and alternating with the fertile ones, the latter being opposite to the segments of the corolla; ovary 4—12 celled, with a solitary ovule in each cell; style single. Fruit fleshy; seeds large, with bony surface. The plants of this order are natives of the tropical parts of Asia, Africa, and America; many yield edible fruits. The seeds of some contain fatty oils. The valuable substance gutta-percha is a product of this order.

SAPPAN-WOOD. (*See* CÆSALPINIA.)

SAPPHIRE, *saf'-fire*, (Gr., *sappheiros*).—A precious stone, next in hardness to the diamond: it consists of nearly pure alumina or clay, with a minute portion of iron as the colouring matter. It is found of various colours; the blue variety being generally called Sapphire, the red the Oriental ruby, and the yellow the Oriental topaz. The finest varieties of sapphire come from Pegu, where they occur in the Capelau Mountains, near Sgriau. Sapphires have also been found in France, Saxony, and Bohemia.

SAPUCAYA, OR SAPUCAIA NUTS.—The seeds of a lofty tree in Brazil, the *Lecythis ollaria*. (*See* LECYTHIDACEÆ.)

SARCINA, OR SARCINULA, *sar'-sin-a.*—A genus of small plants of very low organization, sometimes classed among *Fungi* and sometimes among *Algæ*.

SARDE, OR SARDA.—A variety of quartz, much like carnelian, only that it has a very deep red colour. (*See* CARNELIAN and QUARTZ.)

SARDONYX, *sar'-do-niks* (Gr., *sardonux*).—A reddish-yellow or orange-coloured silicious stone or gem, nearly allied to the onyx, and containing layers of sarde.

SARDINE. (*See* CLUPEIDÆ.)

SARGASSUM, *sar-gas'-sum.*—In Botany, a genus of the natural order *Algæ*. *S. bacciferum* is the gulf-weed of the Atlantic. Its stems are much employed in South America, under the name of goitre-sticks, in the treatment of goitre. Their beneficial effects are due to the large proportion of iodine existing in the plant.

SAROS, CHALDEAN, *sa'-ros, kal-de'-an.*

—A period of time, so termed by the Chaldean astronomers. By a long series of observations of eclipses, they discovered the cycle of 223 lunations or eighteen solar years, which, by bringing back the moon to nearly the same position with respect to her nodes, her perigee, and the sun, brings back the eclipses in the same order. This is supposed to be the period which they named Saros.

SAROTHAMNUS, *sa-ro-tham'-nus.* — In Botany, a genus of the natural order *Papilionaceæ.* *S. scoparius* is the common broom, one of the most elegant of our native shrubs. Its seeds and tops are diuretic and laxative in small doses, purgative and emetic in large doses. They appear to owe their properties to a peculiar alkaloid discovered by Stenhouse, and termed spartiine.

SARRACENIA. (*See* next Article.)

SARRACENIACEÆ, *sar-ra-se-ne-ai'-se-e.* —In Botany, the *Sarracenia*, Water-pitcher, or Side-saddle flower family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*, consisting of perennial herbs growing in the bogs of North America. They have pitcher or trumpet-shaped leaves. Calyx permanent, imbricated; carpels united so as to form a compound ovary, and a 3-celled dehiscing fruit, with large axile placentas. A decoction of the root of *Sarracenia purpurea* has been recommended as a remedy for small-pox; but the opinions of medical men differ widely as to its efficacy.

SARSAPARILLA. (*See* SMILAX.)

SARTORIUS, *sar-to'-re-us* (Lat., *sartor* a tailor).—In Anatomy, is a flat and slender muscle, but the longest of the human body, extending obliquely from the upper and anterior part of the thigh to the upper anterior and inner part of the tibia. It serves to bend the leg obliquely inwards, or to roll the thigh outwards, and at the same time to bring one leg across the other; on which account it has received the name of sartorius, or tailor's muscle.

SASSAFRAS, *sas'-sa-fras* (*Sassafrass*, an American river, on whose banks it grows).—In Botany, a genus of the natural order *Lauraceæ.* The root and wood of *S. officinale*, a North-American tree, are employed medicinally in this country and elsewhere, being stimulant, diaphoretic, and alterative. Volatile oil of sassafras, obtained from the wood, bark, and root by distillation, is also employed as a stimulant. Sassafras pith is used in America as a demulcent, in place of quince-seeds.

SASSAFRAS NUTS. (*See* NECTANDRA.)

SATELLITE, *sat'-e-lite* (Lat., *satelles*, an attendant).—A term applied in Astronomy to certain secondary planets moving round the other planets, as the moon does round the earth. They are so called because always found attending them, for rising and setting, and completing the orbit round the sun together with them. The words moon and satellite are sometimes used indifferently; thus, Jupiter's moons, or Jupiter's satellites, are spoken of; but the term moon is generally applied to the Earth's attendant, and the term satellite to the small moons round Jupiter, Saturn, and Uranus.

SATUREYA, OR SATUREJA, *sat'-ur-e-ya* (Gr., *saturoi*, satyrs).—In Botany, Savory, a genus of the natural order *Labiatæ.* It includes the two well-known flavouring herbs, *S. montana*, winter savory, and *S. hortensis*, summer savory.

SATURN, *sat'-urn.*—The name of an ancient Italian god, who presided over agriculture—*i.e.*, the god who blessed the labour of the sower, &c.

Saturnalia.—The feast of Saturn.

Saturn's Tree. (*See* LEAD TREE.)

SATURN, *sat'-urn.*—In Astronomy, the name given to one of the old planets and the largest of the celestial bodies in the solar system, except the Sun and Jupiter. This planet was known from the earliest times. It shines in the heavens like a star of the first magnitude, is of moderate brightness, and never exhibits traces of scintillations. The slow proper motion of Saturn among the constellations had led astronomers correctly to place it at the extreme limits of our system, at a much greater distance than Mars or Jupiter. The time in which Saturn traverses its entire orbit, or the time of its sidereal revolution, is 29 years, 5 months, and 16 days. Its motion is effected in an elliptical orbit, the plane of which makes with the plane of the ecliptic an angle of 2° 29′ 26″. The inclination of the orbit of Saturn to the terrestrial equator is 22° 38′ 44″. The excentricity of the orbit is 0·056. In magnitude, it is not much inferior to Jupiter, being 79,000 miles in diameter, exceeding the earth in bulk nearly 1,000 times. This stupendous globe, besides being attended by seven satellites or moons, is surrounded by two broad, flat, extremely thin rings, concentric with the planet and with each other. Both these rings lie in one plane, and are separated by a very narrow interval from each other throughout their whole circumference, as they are from the planet by a much wider. The interval between the two rings is estimated at 1,791 miles; and the interval between the planet and the interior ring at 19,090 miles. Seen through the telescope, the ring is observed to throw its shadow on the body of the planet on the side nearest the sun, and on the other side to receive the shadow of the body. From this observation, the fact has been ascertained that Saturn is not self-luminous, but shines only by the reflected light of the sun. The planet itself revolves on its axis in 10h. 29m. 17s., and the rings rotate in their own plane in 10h. 32m. 15s.—(*Sir John Herschel.*) To an inhabitant of Saturn in those regions which lie above the enlightened sides, these rings must present a magnificent spectacle, appearing as vast arches spanning the sky from horizon to horizon, and holding an almost invariable situation among the stars. On the other hand, in the regions beneath the dark side, there must be a solar eclipse of fifteen years' duration, the only light received being the faint illumination of the satellites.

SATYRIASIS, *sat-er-i'-a-sis.*—A name given to a disease in which the lower instincts of mankind are uncontrolled, and the patient recognizes no law to restrain his hunger or thirst and lusts. This disease or insanity was formerly much more common in ancient times than now.

SAURIA, *saw'-ri-a.*—The name given, in the system of Cuvier, to an order of reptiles, which have a long body covered with scales or bony plates, a long tail, mouth furnished with teeth, four limbs, or sometimes only two apparent, the others being hidden beneath the skin, and the young coming from the egg in a similar form to the mature animal. Lizards, chameleons, iguanas, &c., belong to this order; and crocodiles and alligators were, and by some naturalists still are, placed among them, though some naturalists place them among another order.

SAUROID FISHES, *saw'-roid.*—A name sometimes given to fishes, such as the bony pike and sturgeons, which in their structure somewhat resemble saurian reptiles. Fossil sauroid fishes are very numerous.

SAURURACEÆ, *saw-rur-ai'-se-e.* — In Botany, a small natural order of *Dicotyledones*, sub-class *Monochlamydeæ*, consisting of marshy herbs, with alternate stipulate leaves and spiked achlamydeous flowers. They are natives of North America, Northern India, and China. They are of no economic importance.

SAURY PIKE, *saw'-ry.*—A genus of fishes (*Scomberesox*), with a long body, and head also much elongated, with the jaws extended into a long sharp beak like the garfish (which *see*). They belong to the order *Pharyngognathi*, family *Scomberesocidæ*.

SAUVAGESIA, *saw-va-ge'-se-a.* — In Botany, the *Sauvagesia* family, a small natural order of *Dicotyledones*, sub-class *Thalamifloræ*, by some botanists regarded as a sub-order of *Violaceæ*, but distinguished by several minor characters. The plants of this order are natives of South America and the West Indies. Their properties have not been investigated. *Sauvagesia erecta*, the species best known, contains much mucilage, and has been used internally as a diuretic, also externally in diseases of the eye.

SAXIFRAGACEÆ, *saks-e-fra-gai'-se-e* (Lat., *saxum*, a stone; *frango*, I break, because supposed to break or dissolve stones in the bladder).—In Botany, the Saxifrage family, a natural order of *Dicotyledones*, sub-class *Calycifloræ*, having the following essential characters:—Herbs with alternate leaves and unsymmetrical flowers. Calyx inferior, or generally more or less superior, 4—5-partite. Stamens perigynous or hypogynous. Ovary superior, or more or less inferior, composed of 2 carpels, united at the base, and diverging at the apex; styles distinct, equal in number to the carpels. Fruit capsular, 1—2-celled. Seeds numerous, small, with fleshy albumen. The plants of this order are all natives of northern regions, and usually inhabit mountain districts, being sometimes found at a height of 16,000 feet above the sea. They are generally characterized by astringency. This is particularly the case with *Heuchera Americana*, which, under the name of alum root, is much used as an astringent in North America.

SCABIOSA, *skab-e-o'-sa* (Lat., *scaber*, rough, from its hairy surface).—In Botany, a genus of the natural order *Dipsacaceæ*. *S. succisa* is said to yield a green dye. It is called the Devil's-bit scabious, on account of its abruptly-terminated root, which appears as though a piece had been bitten off.

SCALD-HEAD, *skawld.*—This term is probably a corruption of *Scaled-head*, and is the common name for a parasitic fungous disease of the head, known in scientific phraseology as *Favus* or *Porrigo scutulata*, and sometimes as *Tinea favosa*. The head is covered with honeycomb-like masses of scab. The hair must be shaved off, and poultices applied to get off the scab, and then washed with oil of turpentine. If this does not do, a similar treatment to that recommended for ringworm may be applied. (*See* RINGWORM.)

SCALDS. (*See* BURNS and SCALDS.)

SCALE INSECT. (*See* COCCUS.)

SCALES OF FISHES.—In their chemical composition, are something like bones. They have been divided by Agassiz into four classes, according to their forms, *placoid*, *ganoid*, *ctenoid*, and *cycloid*.

Placoid Scales.—These lie side by side without overlapping, and are often elevated in the centre, which elevation forms a strong projecting point. All cartilaginous fishes, except the sturgeon, have these scales.

Ganoid Scales.—These are usually of rhomboidal form, and are imbricated. They are also covered with a fine enamel. The sturgeon and bony pike have these scales; they are also found in fossil fishes.

Ctenoid Scales.—These are of rounded or oval form, with teeth on their lower margin. They have no enamel, but are imbricated. The perch and many osseous fishes have these scales.

Cycloid Scales.—These are soft and flexible, and have a variety of markings. They are imbricated, and consist of concentric layers of horn or bone, without enamel and without a spinous margin. The salmon, carp, herring, &c., have these scales.

SCALP, *skalp.*—The outer covering of the skull, and differing but slightly from the skin covering the other parts of the body. (*See* SKIN.)

Scalping, *skalp'-ing.*—A barbarous custom which prevailed among Indian warriors of taking off the scalps of their enemies, which they preserved as trophies of victory.

SCAMMONY. (*See* CONVOLVULUS.)

SCANSORES, *skan-sor'-ees.* (*See* CLIMBERS.)

SCAPHOID BONES, *skay'-foid.* — The name given to two bones, shaped something like a boat, one of which is in the tarsus of the foot, and the other in the wrist.

SCAPULA, *skap'-u-la* (Lat., the shoulder-blade).—In Anatomy, is the name given to that flat triangular bone passing from the shoulder-joint in a direction towards the vertebral column, and extending, when the arms hang loosely, from the first to about the seventh rib. It presents various irregularities, and is so thin in some places as to be transparent. The outer surface is slightly convex, and divided into two unequal parts by a very prominent ridge or plate of bone, termed the "spine." The use of this bone is to afford a movable fulcrum for the motions of the arm, as well as an extensive surface for the attachment of the muscles which effect the movement.

SCARABÆIDÆ, *skar-a-be'-e-de.*—A large family of pentamerous *Coleoptera*, belonging to the group *Lamellicornes*. They possess antennæ, generally terminated by a club, made up of leaflets, capable of being shut up, but sometimes of box-like joints. The species are about 3,000, and this immense group has been sub-divided into several distinct families.

Divisions.—*Coprophagi*, or dung-feeding beetles. The type of this family is the sacred beetle of the Egyptians. (*See* SCARABÆUS.)—The second family, the *Arenicoli*, contains those specimens in which the elytra entirely cover the abdomen. They make deep burrows in the earth, fly about after sunset, counterfeit death when alarmed.—The third family is that of the *Xylophili*, the males of which have peculiar horns or tubercles on the head or thorax. The fourth family, *Phyllophagi*, contains a number of beetles, called chafers, which feed on the leaves of trees.—The fifth family, *Anthobiæ*, contains species which feed upon leaves and flowers.—The sixth family, *Melitophili*, are also beetles which live upon the juices of flowers.

Scarabœus, *skar-a-bee'-us*.—The sacred beetle of the Egyptians. Also known as Ateuchus.

SCARF-SKIN. (*See* SKIN.)

SCARIFICATION, *ska-re-fe-kai'-shun*, (Lat., *scarificatio*).—In Surgery, is the operation of making small cuts or punctures in the skin by means of lancets or other cutting instruments, particularly the cupping instrument.

SCARLET FEVER, OR SCARLATINA, *skar'-let*, *skar-le-te'-na* (Lat.).—In Medicine, is a contagious febrile disease, almost always attended during a part of its course by a rash and by sore throat. Sometimes only one of these features is well marked, sometimes both. Though persons of all ages are susceptible of it, it is eminently a disease of children. Like small-pox or measles, it rarely attacks a person more than once. It usually comes on with shiverings and a feeling of lassitude, followed by more or less of fever, restlessness, loss of appetite, headache, nausea, and occasionally vomiting. Then, generally on the second day, the eruption begins to come out, though in some of the worst forms it may be deferred to the fourth. In the most regular and favourable cases, the eruption stands out for three or four days, and then begins to fade and decline, becoming, by degrees, indistinct, and disappearing altogether in the majority of instances before the end of the seventh day. The tongue is often covered at the outset with a thick white cream-coloured fur which gradually cleans away, and the surface becomes preternaturally red and raw-looking. There is a sensation of stiffness and pain on moving the neck, with pain on swallowing: the voice is thick, and the throat feels rough and straightened. Physicians distinguish three different varieties of scarlatina; viz., scarlatina simplex, in which there is a florid rash and little or no affection of the throat; scarlatina, anginosa, in which both the skin and the throat are decidedly implicated; and scarlatina maligna, in which the stress of the disease falls upon the throat. In malignant cases, the eruption, if it appear at all, is livid and partial, and fades early, and is attended with a feeble pulse, a cold skin, and extreme prostration of strength. Sometimes the patient sinks at once, and irretrievably, under the virulence of the poison, and life is extinguished in a few hours. The chance of recovery is much greater in anginosa, when the eruption is florid and stands out well; but even here there are various ways in which it may prove fatal. The state of the throat is full of peril, becoming foul and sloughy, and many cases prove fatal in the second week of the disorder. Scarlatina simplex is a very mild form of the disease, and deviates only slightly from a state of health. Scarlatina is also dangerous from its tendency to give rise to other complaints, as boils or strumous ulcers, various forms of scrofula, dropsy, &c. In treating the simplest form of scarlet fever, little else is required than confinement to the house, regulation of the bowels, and the avoidance of all stimulating substances in the matter of diet. In anginosa, frequently, all that is necessary is to keep the bowels open by moderate laxatives, and watch the progress of the complaint. If the heat of the surface is great and distressing, cold or tepid sponging may be adopted; and if the pulse is hard and strong, some leeches may be applied behind the ear. Wet-sheet packs skilfully administered are recommended by some doctors as of great value in reducing feverishness and increasing the action of the skin. If delirium come on, the scalp may require to be shaved and cold applied to it; and if the fever and delirium are violent, blood may have to be taken cautiously from the arm. In the worst form of this disease, all efforts to save the patient will often be unavailing. When the system seems to be overwhelmed with the strength of the poison, a liberal administration of tonics and constant succession of sound nourishment will be required to sustain the flagging powers until the deadly agency has in some measure passed away. As gargles for the throat, a weak solution of chloride of soda or of nitrate of silver, or of Condy's disinfecting fluid is very useful. A solution of chlorate of potash in water (a drachm to a pint) is recommended as a drink in this disease. The bowels also require to be carefully watched; and great care is necessary to avoid cold during the period of convalescence.

SCAUP DUCK.—A species of duck (*Fuligula marila*), inhabiting the northern regions of the world, but coming as far south as Britain and even the Mediterranean in winter time. Especially is it seen in the United States, where it appears on the sea coasts and on fresh water swamps, and beside the banks of large rivers, such as the Mississippi, the Ohio, &c. It belongs to the same genus as the Pochard (which *see*).

SCEPACEÆ, *ske-pai'-se-e*.—In Botany, the *Scepa* family, a small natural order of *Dicotyledones*, sub-class *Monochlamyde*, only distinguished from *Euphorbiaceæ* by its flowers being amentaceous. There are but three genera and six species, all natives of India. The wood of *Lepidostachys Roxburghii* is called *cocus* or *kokra*, and, being very hard, is employed for flutes and similar musical instruments.

SCHINUS, *shy'-nus*.—A genus of shrubs and trees found in South America, and belonging to the natural order *Anacardiaceæ*. The leaves are so full of a turpentine-like, or rather resinous fluid, that at the least swelling of the other part by moisture, it is discharged from the sacs containing it, thus filling the air with fragrance after rain. It is also said that the leaves, if thrown into water, jump about as if alive, discharging this fluid.

SCHIST, *shist* (Gr., *schistos*, split).—A term which in its restricted meaning is applied to the metamorphic strata, consisting of *plates* of different minerals. It is, however, also applied to indurated clays, such as bituminous schist.

SCHIZANDRACEÆ, *skiz-an-drai'-se-e*.—In Botany, the *Schizandra* family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*, consisting of trailing shrubs, with alternate, exstipulate, simple leaves, and unisexual flowers. Sepals and petals imbricated. Stamens numerous, hypogynous. Ovules pendulous; embryo very minute, with abundant homogeneous albumen. There are but five genera and one species, natives of India, Japan, and the southern parts of North America. Some have edible fruits. The genera *Schizandra* and *Sphærostema* are represented by two scrambling shrubs, cultivated in our conservatories.

SCHORL. (*See* TOURMALINE.)

SCHORL ROCK. — The name of a kind of rock usually occurring in granite, and often consisting of quartz and schorl.

SCIÆNIDÆ, *sy-een'-i-de.*—The name given to a family of acanthopterous fishes, of which there are many genera, found both in marine and fresh water. The characteristics are: compressed body, scales ctenoid, simple or double, dorsal fin of which the first part is spiny, head in plated and bones cavernous. The Mogre and the Bearded Umbrina (which *see*) are the only British species.

SCIATICA, *si-at'-e-ka.*—Is a name often applied to all rheumatic affections about the hip-joint and back of the thigh, but in strictness it is applied only to a disease of the sciatic nerve. This is sometimes an inflammatory complaint, requiring for its treatment cupping and blistering; sometimes it is clearly rheumatic, and then requires the mode of treatment adopted for such cases; sometimes it results from irritation within the pelvis, affecting the nerve before it emerges externally, and sometimes it is purely nervous and neuralgic.

SCIENCE, *si'-ens* (Lat., *scientia*, from *scio*, I know).—In its strictly literal sense, means simply knowledge. This was probably the only sense in which it was at first used; but we are told that "by the middle of the 16th century the word science had begun to appear as denoting connected and demonstrated knowledge, in opposition to art, which signified digested rules of operation, not connected with each other by deduction from common first principles;" and "by the middle of the 17th century the term science was freely used in the sense which it has never since lost; namely, that in which it is opposed to literature." Science, as distinguished from art, is a body of organized knowledge, whose phenomena are arranged so as to exhibit the reasons or causes by which they are influenced in their legitimate connection and interdependence. A science which deals with the succession of reason, and consequently is entitled an *abstract* science; while that which deals with causes and effects is called for the most part a *natural* or *physical* science. Those sciences which are supposed to be complete are called *exact* sciences; as geometry. The great majority of what are commonly known as sciences hardly deserve the name, being mere bundles of theories or facts, connected with more or less of exactness, but which a fresh discovery may any day untie. Science, as distinguished from literature, has for its business the discovery and applying of first principles. (*See* various headings, such as BIOLOGY, NATURAL PHILOSOPHY, &c.)

SCIENCE AND ART, DEPARTMENT OF.—A department of the Committee of Privy Council on Education, which owes its origin to suggestions in the second report of the commissioners for the Exhibition of 1851. The suggestions were favourably regarded by the government; and as a part of the "comprehensive scheme for the advancement of the fine arts and of practical science," announced from the throne at the commencement of the session of 1852-53, the Lords of the Treasury in March, 1853, gave their formal concurrence to the proposed arrangement of the Privy Council, to "untie in one department, under the Board of Trade, with the departments of Practical Art and Science, the kindred and analogous institutions of the government School of Mines and Science, the Museum of Practical Geology, the Geological Survey, the Museum of Irish Industry, and the Royal Dublin Society, all of which are in part supported by parliamentary grants." The immediate intention of this amalgamation was to bring the whole of these institutions under one common superintendence, to establish a Central Metropolitan School of Practical Science, as well as of art, and to encourage the formation of minor local institution in connection with the central institution. The whole of these united departments, it will be observed, belonged to England and Ireland; in 1854, however, the necessary steps were taken for the formation of an industrial museum for Scotland, similar to those of London and Dublin. A site was purchased by the government near the University of Edinburgh for the building, and the museum belonging to the town council, and the valuable collection of models, minerals &c., belonging to the Highland Society, were transferred to the Crown; thus forming an excellent basis for the proposed museum. The department of Science and Art, as mentioned above, was originally a section of the Board of Trade; but in February, 1856, it was transferred to the Committee of Privy Council on Education. It now forms a distinct division of that committee, and consists of two sections,—a school of science with its connected museums and affiliated institutions, having its head-quarters at Jermyn Street; and a school of art, with its various collections and associated schools, having its head-quarters at South Kensington, where the head offices of the department are also. The inspectors of the Metropolitan School of Science grant certificates to any teachers who pass a satisfactory examination in 1. practical and descriptive geometry, with mechanical and machine drawing; 2. physics, mechanical and experimental; 3. chemistry; 4. geology; 5. natural history; and those who are successful receive certificate allowances of £20, £15, or £10, in each, while engaged in teaching. The art schools, which are of older date than those of science, appeal to a wider circle. In the words of the official programme, the objects of this department are:—1. To train male and female teachers to give instruction in art; to certify them when qualified, and to make them annual fixed payments, varying according to their acquirements.—2. To aid and assist committees in the provinces desirous of establishing schools of art.—3. To hold public inspections and examinations, and to award medals and prizes to the most deserving candidates.—4. To collect together works of art, pictures, &c., in the central museum, and books and engravings in the central library.—5. To circulate among the schools of art objects from the museum, and books and engravings from the library." Amongst the buildings at South Kensington are included the offices of the department, the Training School for Masters and Mistresses, the Normal Central School of Art, the Art Library, and the Museum.

SCINK, OR SKINK.—A reptile found in the north of Africa, and also in some parts of Asia. It has been thought highly of for its supposed medicinal virtues, dried skinks even now being sold in places like Cairo, &c. It belongs to the family *Scincidæ*, and forms a connecting link between the saurians and the serpents.

In appearance it is much like a lizard, being about six or eight inches long, of a reddish colour with bands of darker hue, a wedge-shaped head and four legs.

SCINTILLATION, *sin-til-lay'-shun.*—Means sparkling or twinkling, and is often applied to the twinkling of the stars. The reason of the scintillation of the stars and the non-scintillation of the planets is not yet quite clear.

SCIOGRAPHY, *si-og'-ray-fy.*—The method of drawing sections of buildings so as to show their interior.

SCIRPUS, *skir'-pus* (Lat., a bulrush).—In Botany, a genus of the natural order *Cyperaceæ.* Various species, commonly known as club-rushes or bulrushes, are much employed for mats, chair bottoms, baskets, &c., and by coopers for filling up intervals in the seams of casks.

SCIRRHUS.—The name given to a variety of Cancer. (*See* CANCER.)

SCITAMINEÆ, OR ZINGIEBRACEÆ.—A natural order of tropical or subtropical plants, including about 250 species, among which are the various kinds of Ginger, Turmeric, Cardamom, &c. They are all endogenous, and herbaceous perennials, and most are noted for their aromatic properties.

SCLERANTHACEÆ, *skle-ran-thai'-se-e,* (Gr., *skleros,* hard; *anthos,* a flower).—In Botany, a small natural order of *Dicotyledones,* sub-class *Monochlamydeæ,* consisting of inconspicuous herbs found in barren places in temperate regions. They are placed by some botanists among the *Paronychiaceæ.*

SCLEROSTOMA, *skler-os'-to-ma.*—A genus of worms which infest the trachea of poultry, and cause the disease called the Gapes.

SCORPION, *skor'-pe-on* (Lat., *scorpio*).—A formidable insect allied to the spider, but differing greatly in form, being distinguished from it by having the abdomen articulated with a curved spur at the extremity, under the point of which are two small orifices, which serve to give passage to a poisonous fluid. The anterior pair of feet or palpi are very large, resembling those of the lobster in form. The other feet do not differ essentially in form from those of spiders. On the under side of the thorax are two comb-like appendages, the use of which is not well understood. Scorpions inhabit the hot countries of both hemispheres, live on the ground, conceal themselves under stones and other bodies, and not unfrequently taking up their abode in houses. When disturbed, they run rapidly with the tail over the back, ready to turn it in any direction, either for attack or defence. They feed on insects and their eggs. The species of the south of Europe are little more than an inch in length, whilst some of the tropical species exceed five inches; and the sting of the latter produces serious symptoms, which are said frequently to result in death. The young scorpions are produced at various intervals, and are carried for several days upon the back of the parent, during which time she never leaves her retreat. The genus is divided by naturalists in sub-genera, depending upon the number of the creatures eyes, whether six or eight.

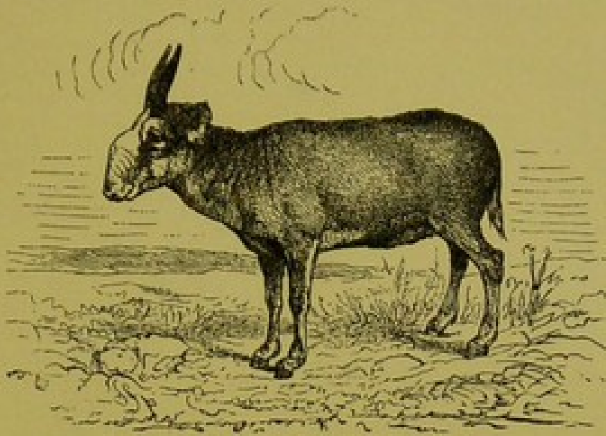
SCORZONERA, *skor-zon-e'-ra* (*scorzo,* an old Spanish word for viper, because it was held to be effectual against the bite of venomous animals).—In Botany, a genus of the natural order *Compositæ.* The roots of *S. hispanica, glastifolia, deliciosa* and *tuberosa,* are eaten in different parts of the world, being boiled or stewed in the same manner as carrots or parsnips.

SCREW PINE. (*See* PANDANACEÆ.)

SCROFULA, OR KING'S EVIL, *skrof'-u-la* (also sometimes spelled SCROPHULA).—A tedious and multiform disease, hereditary in its nature, and one of the most characteristic marks of which is a tendency to swelling of the glandular parts, which sometimes suppurate and discharge a curdy mixed matter, and are very difficult to heal. The name is said to be derived from the Latin *scrofa* or *scropha,* a sow, probably from the fancied resemblance of the swellings to a pig; and the term king's evil has been given to it from its being long believed to be curable by the royal touch. (*See* EVIL, KING'S.) The persons in whom scrofulous disease is most apt to manifest itself are marked during childhood by pale and pasty complexions, large heads, narrow chests, protuberant bellies, soft and flabby muscles, and a languid and feeble circulation. It, however, often accompanies a variety of the sanguineous temperament also, and is indicated by light or red hair, gray or blue eyes, with large and sluggish pupils, and long silky lashes, a fair transparent brilliancy of skin, and rosy cheeks. This red colour is, however, easily changed by cold to purple or livid, and the extremities are subject to chilblains. Such children are often extremely clever, and ready of apprehension, of eager tempers and warm affections, lively, ardent, imaginative, and susceptible. It is frequent, also, though less common, in what is called the melancholic or bilious temperament—*i.e.,* in persons of dark, muddy complexion and harsh skin, in whom the mental and bodily energies are more sluggish and dull. The disease, however, frequently occurs in persons who do not exhibit any of these symptoms. It is one of those diseases that are in a marked degree hereditary. Like other hereditary tendencies, it may sometimes skip over a generation or two, and reappear, just as family likenesses do. The tendency may be so strong that no care will prevent its manifestation, or so faint as never to break out into actual mischief, if the exciting causes be warded off. Among the exciting causes are insufficient nutriment, exposure to wet and cold, impurity of the atmosphere, the want of natural exercise, and mental disquietude. Climate exercises a very marked influence upon it, and there is none more favourable for its development than our own. A moist, cold, and variable climate is particularly favourable to its development, while, on the other hand, a hot or a very cold climate protects against it. Scrofula usually manifests itself in indolent glandular tumours, frequently in the neck, at first free from pain and inflammation, but proceeding slowly to an inflammatory state, and gradually and generally, after a long time, forming an ulcer, which is extremely difficult to heal. In some cases the eyes and eyelids are the principal seat of the disease, having constantly a very inflamed aspect. The bones of scrofulous persons are also liable to disease, especially those of the spine; and generally the diseases and accidents that happen with comparatively little inconvenience to others, are productive of very troublesome and alarming consequences in scrofulous constitutions.

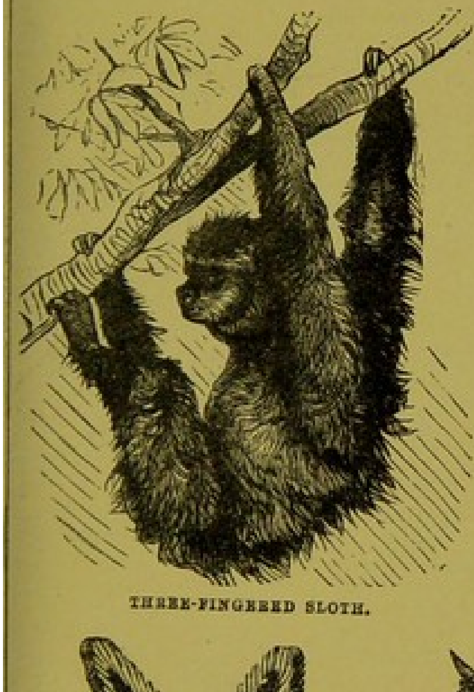
SAFFLOWER.

SAFFRON.



SAIGA, OR ANTELOPE OF THE STEPPES.

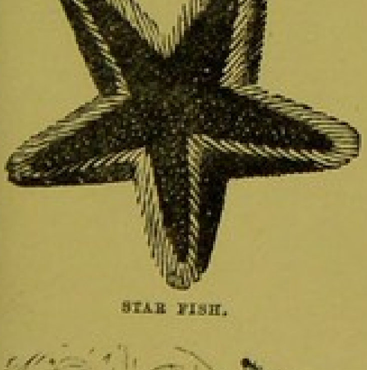
SENNA.



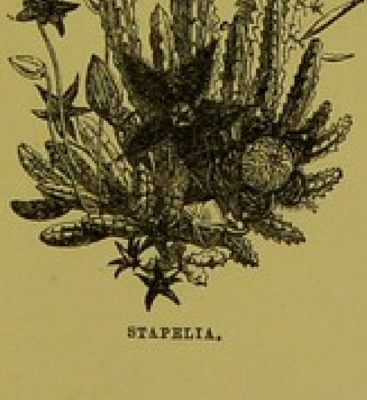
THREE-FINGERED SLOTH.

SAGO PALM.

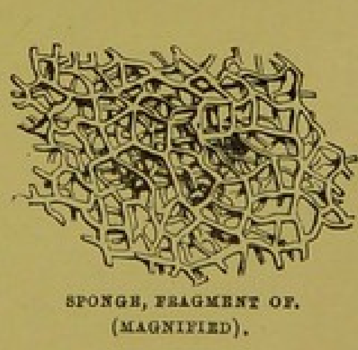
SCORPION.



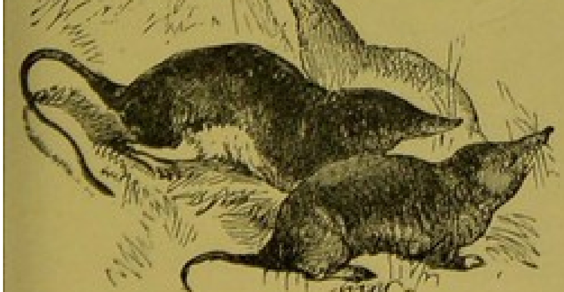
STAR FISH.



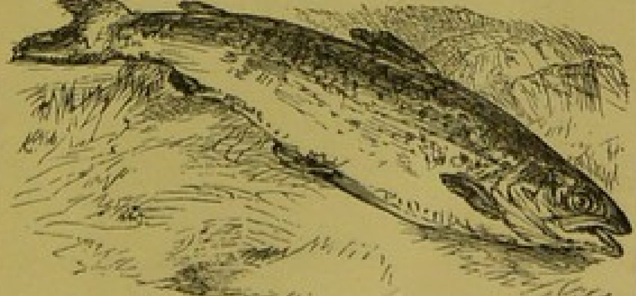
STAPELIA.



SPONGE, FRAGMENT OF. (MAGNIFIED).



SHREWS.



THE SALMON.

The lungs are particularly liable to attack in such cases, giving rise to the formation of tubercles in that organ, which are so marked a feature in PHTHISIS (which *see*). The treatment consists chiefly in raising the tone of the system by moderate exercise in the open air, with suitable nourishment, sufficient clothing, and attention to the state of the bowels. Sea-bathing, if it can be borne, or sponging the skin with tepid salt-and-water, followed by diligent rubbing with coarse towels and the flesh-brush, are very beneficial. Much good is frequently derived from the use of cod-liver oil; and iodine is often found to be of benefit.

SCROPHULARIACEÆ, *skrof-u-la-re-ai'-se-e.*—In Botany, the Figwort family, a natural order of *Dicotyledones*, sub-class *Corolliforæ*, thus defined by Miers and Bentley:—Herbs or rarely shrubby plants, with opposite leaves generally. Inflorescence axillary. Flowers anisomerous, irregular. Calyx persistent, 4—5-partite. Corolla more or less irregular, 4—5-partite; æstivation imbricate. Stamens 2, or 4 didynamous, rarely 5, with introrse anthers. Ovary usually 2-celled, its component carpels being placed anterior and posterior; style 1. Fruit usually capsular, rarely baccate, generally 2-celled; placentas axile. Seeds generally numerous, albuminous; embryo straight or slightly curved. The plants of this order are found in all parts of the globe, and a great number are cultivated in our gardens on account of the beauty of their flowers. (*See* ANTIRRHINUM and CALCEOLARIA.) Some are powerful poisons, and all must be regarded with suspicion. The most important medicinal plant of the order is the foxglove. (*See* DIGITALIS.)

SCURVY, OR SCORBUTUS, *skur'-ve*, (Lat., *scorbutus*).—In Medicine, is a disease which two centuries ago was endemic in all the northern countries of Europe, but which has been now almost entirely extinguished. It is still a disputed point whether this disease was known at all to the ancients; but of its prevalence in the Middle Ages there is abundant testimony. It appears to have existed in the north of Europe from the most remote antiquity, resulting from the imperfect state of agriculture and the frequent famines that prevailed. Even as late as 1836-8 the reports of inspectors of prisons abound with instances of the occurrence of scurvy in our gaols and prisons, owing to the prolonged use of a diet in which fresh succulent vegetables formed no part. It was, however, more particularly at sea that the fearful ravages of this scourge prevailed. Even as recently as the time of Lord Anson, scurvy was so fatal that, during the first two years of his voyage, he lost more than two-fifths of his original crew. The first indication of scurvy is usually a change in the complexion, from its naturally healthy hue to a pale, slightly sallow, and dusky appearance, attended with great languor and despondency, and aversion to every kind of exercise. The patient is readily fatigued, and complains of pain in the muscles, especially of the legs and loins, similar to those produced by over-exertion. The gums soon become sore, and apt to bleed on the slightest touch, and on examination are found to be swelled and spongy, and of livid redness. As the disease advances, all these symptoms become more marked, the complexion acquires a more dingy and somewhat brownish hue; the debility increases, so that the least exertion causes breathlessness and palpitation, and not unfrequently an alarming syncope; the gums become more swelled and more livid, forming, in some cases, a black spongy mass, completely concealing the teeth, which frequently become loose, and drop out without undergoing decay: and the breath is remarkably offensive. The patient is also subject to hemorrhages, more particularly from the gums and nose, but often also from the intestines, lungs, or stomach. Ecchymoses also appear on the skin, in the form of petechial spots, particularly on the lower extremities, but frequently occurring also on the arms and trunk. Effusions of blood also take place under the skin in various parts, especially in the lower extremities and around the seat of an old injury. These parts are painful when pressed or moved, and are much swollen. Their most common seat is the ham, where the swelling is often considerable, and always attended with stiffness and contraction of the knee-joint. Sometimes old wounds break out afresh, and a broken bone will become disunited, though it has become consolidated for some time. The natural secretions are scanty, the skin is dry and rough, and there is a suppression of perspiration. The appetite, however, continues good, and the powers of digestion are unimpaired; the intellect is unaffected, and in early stages the patients generally sleep well. The tendency to swoon, however, is very great, and sometimes even the slightest motion produces fainting, which sometimes proves fatal. Scurvy is most common in winter or the beginning of spring. It is not contagious, neither is it caused by cold weather, by impurity of air, nor by the continued use of salt provisions, all of which have frequently been alleged. It is owing solely to the privation for a considerable length of time of fresh succulent vegetables, and is infallibly and rapidly cured by the administration of these or of lemon-juice. The latter is really a specific against scurvy, whether it be employed as a preventive or as a remedy. It supplies something to the blood which is essential to its healthy properties. As for the rest, fresh animal food, with potatoes, fresh vegetables and ripe fruits are of advantage; but bleeding, blistering, or mercury in any form, should be religiously avoided.

SCURVY-GRASS. (*See* COCHLEARIA.)

SEA. (*See* OCEAN.)

SEA CUCUMBER. (*See* HOLOTHURIA.)

SEA-DEFENCES.—When a sea-shore is attacked either by the action of the tide or the littoral currents, it becomes necessary to protect the shore from the gradual abrasion that results. The sea-defences thus required are constructed on principles which depend not only upon the destructive action to be operated against, but also on the nature of the materials to be used. When the shores are rocky, and of the granitic and crystalline formations, the sea acts generally by direct impact or by tidal currents. In such cases, and especially when deep water comes close in shore, the best and most economical mode of defence is to build a solid masonry wall, of large hard stones, with a curvilinear batter of about one in forty from the sea. The sudden interference with the translation of a deep-sea wave should always be avoided in sea-defences, especially when it has been driven for a short distance over an inclined fore-shore, and has been exposed to the action of winds or currents able to increase the velocity. In some cases, this velocity has been observed to attain as much as seventy feet per second. The spray has sometimes been dashed over the top of the Bell Rock, on the east coast of Scotland, a height of 117 feet. Another kind of sea-defence is that used in order to guard against the tendency of breaking waves to undermine the footings on the seaward face by the receding wave, or *undertow*, as it is technically called. In the more movable strata, this object is effected by constructing a kind of flat wall, presenting the same inclination as the natural line of the fore-shore. The sea-slope at the Plymouth breakwater was paved with large blocks of marble or granite, dovetailed and cramped together at an enormous cost. On the Dutch coast, where the inclining angle of the shore is very flat, the apron-walls of sea-defences are often made of brickwork, set with trass mortar in wooden frames. At Cherbourg, the sea-slope is protected by huge blocks of rubble masonry set in Portland cement. Where shores consist of soft alluvial formations, their defence is effected in various manners, according to the skill of the engineers and the natural outlines formed by the action of the currents.

SEA-GRAPE.—A genus of plants (*Ephedra*) belonging to the natural order *Gnetaceæ*, which are small shrubs with jointed stems, from which they are sometimes called Joint Firs. There are but few species, they much resemble the *Coniferæ*.

SEA-KALE. (*See* CRAMBE.)

SEAL.—A genus (*Phoca*) of the family of marine carnivorous mammalia named *Phocidæ*. The genus *Phoca* comprises a great amount and a considerable diversity of species. The members of it resemble a quadruped in some respects and a fish in others. Their feet are so short and so encompassed in the skin, as to render their terrestrial movements very awkward, and their terrestrial motion is effected by a sort of shuffling, jumping motion, in which the spine and the muscles of the body are principally employed, though the extremities are used in getting, or rather climbing, out of the water upon a rock or other projecting body; but as the intervals of their toes are filled by membranes admirably adapted for swimming, their swimming powers are nearly inexhaustible, and they pass the greater portion of their lives in the water. The form of the body is elongated, the spine extremely flexible, the muscles very powerful, and the fur close and short. Considered as regards their structure, their principal place of abode, and their motions, they hold a place between the land mammalia and the cetacea, or whales. They have all the three kinds of teeth, and in this particular resemble the land carnivora, and there is little doubt that their chief food is fish, caught alive in the water, an operation in which they are very expert. The head is round, and the nose, which is broad, is like that of a dog, with the same look of intelligence and mild expressive physiognomy. It has large whiskers, oblong nostrils, and black sparkling eyes. The arms and fore-arms of the seal are very short, and wholly concealed under the skin of the shoulder and breast; the fingers, as already said, being united by a membrane into a sort of paw or paddle. The hind legs are still more concealed, and have less of independent motion than the fore ones; but the toes are more webbed, and they are altogether more efficient in swimming. The brain of the seal is well developed, and the degree of sagacity and attachment which they show in domestication is evidence of superior intelligence. Seals have the power of opening or closing their nostrils at pleasure, and the interval between their respirations is very long; the closing being effected by sphincter-like muscles acting upon valvules, which close the aperture most effectually. The auditory nerve is very large, and though the auricular opening is closed by a mechanism somewhat similar to that which shuts the nostrils, it is evident that seals hear very well even under water. The members of the seal family are amongst the most numerous of all mammalia that attain anything like an equal size. On some parts of the British coasts they are plentiful, especially on the more northern ones; but in other places they literally swarm. Estuaries and straits are their favourite grounds, evidently because the fishes, which are more dispersed in the open seas, congregate in greater numbers in the currents of these narrow places. They are excellent swimmers and ready divers. Their heads in swimming are always above the water, in the manner of that of a dog. They have their dens or lodgments in hollow rocks or caverns near the sea, but out of the reach of the tide. They sleep and bask on rocks surrounded by the sea, or on the less accessible parts of cliffs left dry by the ebb of the tide, and if disturbed by anything, at once make for the water; and they are said to be so watchful and wary that they never sleep for more than a minute or two at a time, frequently raising up their heads to see if there is any sign of danger.

The Common Seal (*Calocephalus vitulinus*), the typical one of the genus, is found upon the shores of all the colder places in Europe. It is usually about five or six feet in length. The ground-colour of the hair or skin, when the animal is alive and dry, is pale whitish-gray, with a very slight tinge of yellow; when just out of the water and wet, it is ash-colour. After death, and as seen in museums, the ground-colour is pale yellowish-gray; the oil having penetrated the skin and rendered the hair of a more yellow hue. The body above is clouded and marbled with blackish-gray. Space round the eyes and muzzle, sides of the body, and all the lower parts and the feet, pale grayish, becoming nearly white beneath. There is some brown on the muzzle and upper part of the tail; whiskers moderate, undulated; claws black and rather strong; length from three to five feet. It inhabits the northern seas generally, the coasts of England, France, &c. It is comparatively scarce on the southern coasts of Britain now, but still haunts the estuary of the Tees, where it is captured for the sake of its skin and the oil its fat yields.

The Harp Seal (*Calocephalus grœnlandicus*) has hair that is drier, closer to the leather, and more free from wool than that of the other species; each hair flat and lustrous. This species is very numerous in the deep bays and the mouths of the rivers in Greenland, where they live in vast herds among the floating ice-islands, and are sometimes seen swimming in great numbers, under the guidance of one who seems to act as leader and sentinel for the whole. Their food consists of all kinds of fish, shell-fish included. To the Greenlander they are all in all, giving him light, food, and clothing. He goes to hunt it in his canoe, which is in the form of a weaver's shuttle. When he perceives a seal, he endeavours to surprise it unawares, with the wind and sun at his back, that he may be neither heard nor seen. He approaches it rapidly, but silently, till within three or four fathoms. He then takes hold of the oar in his left hand, and with his right throws the harpoon. If it is fixed, the Greenlander throws the attached buoy overboard on the same side that the seal dives, and he dives upon the instant. The struck victim often carries the buoy under water; but, wearied and wounded, it must at last come up to breathe. The hunter, who is on the watch, now attacks it with his long lance, till the animal is exhausted, when he releases it from its sufferings with his short lance.

Sub-genus Stenorhynchus.—The seals belonging to this sub-genus are distinguished by the great elongation and the slenderness of the muzzle, which is the foundation of the name. The claws on the toes are very small, and altogether they have a much more aquatic air about them than the common seal. They are found about the Falkland Islands and New Georgia; but of their natural history little or nothing seems to be known.

The Sub-division Pelagius, have the muzzle elongated, but very much enlarged towards the extremity; and the claws on the hind feet are sometimes altogether wanting. One of the species, *Pelagius monachus*, the monk-seal, a native of the Adriatic and the coasts of Sardinia, is supposed to be that whose skin was always carried everywhere by the Emperor Augustus, as a protection against lightning, in accordance with a general Roman superstition.

The Sub-division Stemmatopus, consist only of one species. **The Crested Seal** (*Stemmatopus cristatus*), has the head surmounted by a peculiar organ, which is erectible at the pleasure of the animal, and the use of which is not known. This species, which is about eight feet long, is found on the coasts of Greenland and of North America, down to the United States. Its bite is formidable, and its voice is said to resemble the bark and whine of a dog. It is one of the species most generally pursued, and together with the rough seal, *Calocephalus hispidus*, furnishes the greatest number of the seal-skins brought to Great Britain.

Sub-division Macrorhinus.—**The Elephant Seal** (*Macrorhinus proboscideus*), which belongs to this subdivision, is remarkable for the nose of the male being prolonged into a kind of proboscis, which respires violently when the animal is excited. This seal, which is enormous when compared with the ordinary seal, as it sometimes attains a length of twenty-five feet and upwards, is found in the southern hemisphere, both in the Atlantic and Southern oceans, South Georgia, Juan Fernandez, South Shetland, and the Falklands. It is fond of wallowing in fresh-water swamps, and resorts to rivers and lakes, whose waters it drinks with apparent pleasure. The cry of the female and young is said to resemble the lowing of an ox, whilst the voice of the male is described as being a hoarse gurgling sound, which is heard to a great distance, and is wild and frightful. They are a harmless race, never attacking man unless in defence of themselves and their young, and readily tamed by kind treatment. Their tongues when salted are considered savoury and wholesome, but the flesh is black, oily, and indigestible. The skin, though not valued for its fur, is extensively used for carriage and horse harness, on account of its great strength, but its oil is the great object for which the animal is hunted. There are also two more species, the *Sea-Bear* and *Sea-Lion*. (*See* OTARY, SEA-LION.)

SEA-LION.—This name has been given to various kinds of large animals like seals (*see* SEAL), either from their roaring voice, maned necks, or savage appearance. They have also small external ears from which they are called otaries. The northern sea-lion is about 15 feet long and weighs about 1600 lbs. The males have a quantity of hair on their neck, and thick claws covered with coarse tawny red hair. They feed on fish, small seals, and marine birds and animals. The southern sea-lion (*Otaria Jubata*) is much the same as its northern brother. It yields excellent oil.

SEA-MOUSE, *sea'-mowse* (*Halithæa aculeata*).—This animal, which belongs to the division of animals named *Annelida* (*see* ANNELIDA), is very beautiful, and most richly coloured. It is oval, six or eight inches long, and two or three inches wide. The scales of the back are covered and hidden by a kind of flocky down, which springs from the sides, and from which issue groups of strong spines, that pierce in part the flocky covering, and bundles of flexuous bristles, glittering like gold, and changing into all the colours of the rainbow. Lower down is a tubercle, out of which come spines in three groups and of three different sizes, and finally a fleshy cone. There are forty of these tubercles on each side, and between the first two are two small fleshy tentacles.

SEA-PERCH. (*See* BASSE.)

SEA-SERPENT.—A term applied to a huge animal like a serpent, which is supposed to inhabit the sea. The appearance of a huge monster of this kind has been frequently reported by creditable persons in late years; but in general the sea-serpent is looked upon as a fabulous animal. (*See* KRAKEN.)

SEA-URCHIN. (*See* ECHINIDÆ.)

SEA-WEED. (*See* ALGÆ, FINCACEÆ.)

SECALE, *se-kai'-le* (Lat.).—In Botany, a genus of the natural order *Graminaceæ*. *S. cereale*, the common rye, is much cultivated in the northern parts of the world for its grains. Rye-bread is very wholesome, and retains its freshness for a much longer time than wheaten bread. Quass or rye beer, is a favourite drink in Russia. Rye is subject to a disease called ergot, produced by the attack of fungi (*see* CORDYCEPS), when its grains assume an elongated and curved form. These diseased grains are commonly known as ergot of rye, or spurred rye, and are used medicinally to excite uterine contractions in labour; in certain doses, they are poisonous.

SECOND, *sek'-ond* (Lat. *secundus*).—The sixtieth part of a minute, whether of time or of angular measure. In the old treatises on astronomy, the sixtieth part of a second is similarly called a third.

SECOND SIGHT.—A power believed to be possessed by some persons in the highlands and islands of Scotland of foreseeing future events. Things distant or future are seen as if actually present, with all their circumstances and surroundings. Accidents are said to be thus foreseen, funeral processions, marriages, the arrival of strangers, and such-like. This faculty is neither voluntary nor constant, and is said to be rather troublesome than agreeable to the possessor of it. Though the belief in the second sight is rapidly disappearing, it still lingers in the remoter parts of the north of Scotland. The stories that are reported of it can scarcely be regarded as sufficiently supported by evidence. "It is not wonderful," says Dr. Beattie, "that persons of a lively imagination, immured in deep solitude, and surrounded with the stupendous scenery of clouds, precipices, torrents, should dream (even when they think themselves awake) of those few striking ideas with which their lonely lives are diversified, of corpses, funeral processions, and other subjects of terror, or of marriages and the arrival of strangers, and such-like matters of more agreeable curiosity." Dr. Johnson, who was himself a believer in it, affirms that the islanders of all degrees, whether of rank or understanding, universally admit it, except the ministers, who, according to him, reject it in consequence of a system against conviction. Sir Walter Scott has made good use of the second sight in several of his works, particularly the "Lady of the Lake" and the "Legend of Montrose."

SECRETARY BIRD.—A genus of birds of prey (*Gypogeranus*), the best known species of which inhabits South Africa. It has a crest of long feathers, and the name *secretary* was given to it because these feathers were thought to resemble pens placed behind the ear. It is very useful in attacking and eating serpents, even the most venomous.

SECRETION, *se-kre'-shun* (Lat. *secretio*).—In Physiology, is that process by which materials are separated from the blood, and from the organs in which they are formed, for the purpose either of serving some ulterior office in the animal economy or of being discharged from the body as excrement. Secretion is one of the natural functions of the living body, and is as necessary to health as nutrition. Where the secreted materials have some ulterior purpose to serve, they are known as secretions; where they are discharged from the body, excretions. Most of the secretions seem to consist of substances not pre-existing in the same form in the blood, but requiring special organs and a process of elaboration for their formation. Excretions, on the other hand, commonly or chiefly consist of substances existing ready formed in the blood, and are merely extracted therefrom. In general, however, the structure of the parts engaged in eliminating excretions is as complex as that of the parts concerned in the formation of secretions. The secretions may be arranged into three sorts: (1) exhalations, (2) follicular secretions, and (3) glandular secretions. The exhalations take place as well within the body as at the skin, or in the mucous membranes, and are thus divided into external and internal. The follicles are divided into mucous and cutaneous, and into simple and compound. In almost all the points of the skin little openings exist which are the orifices of small hollow organs with membraneous sides, generally filled with an albuminous and fatty matter. The consistence, colour, odour, &c. are variable, according to the different parts of the body, and which is continually spread upon the surface of the skin, rendering it less impervious to moisture, &c. The small organs are called the follicles of the skin The glands, however, are the principal organs to which the office of secreting is more especially ascribed, and the number of them is considerable. The glandular secretions are of seven different sorts; namely, the tears, saliva, bile pancreatic fluid, urine, semen, and milk.

SECRETIONS.—In Botany, in consequence of the action of air and light upon the watery contents of the green leaves of plants, the materials within them are subjected to a very active chemical condition, by which various substances are formed,—as protein matters, gum, sugar, starch, &c., all of which are essentially necessary to the growth of the plant. Besides these are other matters, such as colouring substances, numerous acids, various alkaloids, &c., which, after their production, perform no further active part in the plant, and are hence removed from the young and vitally active parts, to be stored up in the older tissues of the plant as *secretions*, or removed altogether from them as *excretions*.

SECTIONS, CONIC. (*See* CONIC SECTIONS.)

SECTOR, *sek'-tor* (Fr. *secteur*).—In Geometry, literally, that which cuts; that, for instance, which, being applied to a circle, cuts off part of it. The term sector is also applied to a mathematical instrument, consisting of two rulers, representing the radii of a circular arc, and movable round a joint, the middle of which forms the centre of the circle: various scales are drawn on the faces of the rulers from this centre, which are useful in making diagrams, laying down plans, &c.

Sector.—In Astronomy, is an instrument for determining with great accuracy the zenith distances of stars passing within a few degrees of the zenith, when the effect of refraction is small.

SEDATIVE, *sed'-a-tive* (Lat. *sedatus*, calm).—In Medicine, an agent which produces a direct depression of the action of the vascular system with little sensible evaculation. Inasmuch as their depressing effects are not preceded by any obvious excitement or increased movement of the heart or arteries, they differ from narcotics. It is not clearly ascertained whether they act primarily on the heart itself or by a previous influence on the nervous system. The medical employment of sedatives should only be had recourse to under competent medical authority and superintendence.

SEDUM, *se'-dum*.—In Botany, a genus of the natural order *Crassulaceæ*. *S. acre* is the common yellow biting stonecrop often seen growing on walls. It is of an acrid nature, as its name implies, and is reputed to possess emetic and purgative properties. Lindley states that in Ireland the leaves of *S. dasyphyllum* rubbed among oats are regarded as a certain cure for worms in horses.

SEED, *seed* (Sax., *sæd*).—In Botany, the mature or fecundated ovule. It consists essentially of the young plant or embryo, enclosed in integuments, of which there are usually two. It varies much in form; thus, it may be *rounded*, as in the watercress; *reniform*, as in the poppy; *obovate*, as in the larkspur, &c.; similar terms being employed in describing these forms to those applied to like modifications of other organs. The outer integument or seed-coat is termed the *testa*, or *episperm*. It is usually of a brown or somewhat similar hue, as in the almond; but it frequently assumes other colours. It varies in texture, being soft, fleshy, membraneous, coriaceous, &c. It is often curiously marked with furrows, ridges, &c., and often furnished with hairs, spines, wings, and other appendages. The inner integument is called the *tegmen*, or *endopleura*: it is generally of a soft and delicate nature. A third integument, more or less complete, is occasionally found on the surface of the others. (*See* ARILLUS.) The inner portion of the seed, called *nucleus* or *kernel*, may either consist of the *embryo* alone, as in the wallflower and the bean, or of the embryo enclosed in *albumen* or *perisperm*, as in the pansy. When the nourishing matter called the albumen is present, the seed is said to be *albuminous*; when it is absent, to be exalbuminous. (*See* ALBUMEN, EMBRYO, OVARY, OVULE, PLACENTA.)

SEGGAR, *seg'-gar*.—In Pottery, a vessel used to protect delicate work when burned in the kiln from the too fierce action of the fire.

SEGMENT, *seg'-ment* (Lat. *segmentum*).—In Geometry, a term applied to a part of a figure cut off by a line or plane. The term is, however, more particularly applied to that part of a circle which is comprised between a chord and an arc of that circle, or so much of that circle as is cut off by the chord. A segment of a sphere is that portion of it which is cut off by a plane.

SEIDLITZ POWDERS, *seed'-litz*.—Two

powders put up in white and blue papers respectively, and on being mixed up in water forms an effervescing and aperient draught. They are usually made by compounding 120 grains of tartrate of soda and potash with 40 grains of bicarbonate of soda in powder; this is contained in the blue paper. The contents of the white paper are 35 grains of tartaric acid. The contents of the blue paper having been dissolved in half a tumbler of water, the tartaric acid is stirred, in and the draught should be taken during effervescence. To add to its aperient quality a little sulphate of magnesia may be added.

SEIR FISH, *seer.*—A fish (*Cybium guttatum*) something like a salmon, found in the seas of the East Indies. It belongs to the family *Scomberidæ*.

SEISMOLOGY, *sise-mol'-o-je* (Gr. *seismos*, an earthquake; *logos*, a discourse).—A term applied to a branch of knowledge which has for its object to discover the laws which regulate the occurrence of earthquakes.

SELAGINACEÆ, *se-la-jin-ai'-se-e.*—In Botany the *Selago* family, a natural order of *Dicotyledones* sub-class *Corolliflorœ*, consisting of herbs or shrubs, with alternate exstipulate leaves, and irregular, sessile, bracteated flowers. They are chiefly natives of the Cape of Good Hope; the most interesting genus, however, is European. (*See* GLOBULARIA.)

SELENITE, *sel'-e-nite* (Gr.).—The common name for crystallized sulphate of lime, it occurs in numerous localities in transparent rhomboidal crystals.

SELENIUM, *se-le'-ne-um* (Gr., *selene*, the moon).—In Chemistry—symbol Se, equivalent 39·62, spec. grav. 4·8. This rare elementary body was first discovered by Berzelius in the refuse of a sulphuric-acid factory at Fahlen, in Sweden: since then it has been found in various other localities. It is chiefly interesting from its great resemblance to sulphur in many of its physical and chemical characteristics. It is a dark metallic-looking brittle solid, with a glassy fracture. It has neither taste nor smell, is insoluble in water, and is a non-conductor of heat and electricity. It may be obtained like sulphur both in an amorphous and a crystalline form. Heated in the air, it takes fire with difficulty. It burns with a blue flame, but part of it volatilizes It forms with oxygen three compounds, SeO_1, SeO_2, and SeO_3. The last two are selenious and selenic acid. Selenious acid forms selenites with the bases, which are insoluble in water, with the exception of those formed with the alkalies. Selenic acid is very similar in character to sulphuric acid, its salts being isomorphous with the sulphates of the same bases. Seleniuretted hydrogen resembles its sulphur analogue very closely. Its odour is, however, very much more offensive. Berzelius found that the inhalation of a bubble the size of a pea deprived him of the sense of smell for several hours. Selenium, like sulphur, forms a compound with cyanogen.

SELONOSTEMMA ARGEL, *se-lon-os-tem'-ma.*—In Botany belongs to the natural order *Asclepiadaceæ*, or Milkwort order, the plants belonging to which are chiefly remarkable for their bitter acrid juice. The leaves of *Selonostemma argel* have been much employed to adulterate Alexandrian senna.

SELTZER WATER, OR SELTERS WATER.—The name of a natural mineral water found at Lower Selters, near Limburg. It contains carbonic acid, carbonate of soda, and common salt, and is much recommended to those suffering from liver complaint, and also for use in hot climates. More than a million bottles of this famous water are annually exported, in addition to which artificial seltzer water is very largely manufactured. (*See* ÆRATED WATERS, MINERAL WATER.)

SEMAPHORE, *sem'-a-fore* (Gr., *sema*, a sign; *phero*, I bear).—A term very frequently used synonymously with telegraph; but which may be applied to any system of communicating intelligence by signals.

SEMECARPUS, *sem-e-kar'-pus* (Gr., *semikoo*, I mark; *karpos*, fruit).—In Botany, a genus of the natural order *Anacardiaceæ*. *S. Anacardium* yields the marking-nuts of India, which are employed, with the fruits of *Holigarna longifolia*, in preparing the celebrated black varnish of Sylhet. This is extensively used for lacquer-work and for marking linen. The seeds are edible, like those of the cashew. (*See* ANACARDIUM.)

SEMENCINE, SEMEN CINÆ, OR SEMEN CONTRA. (*See* ARTEMISIA.)

SEMNOPITHECUS, *sem-nop-ithee'-kus.*—The name of a genus of monkeys found in the East. The Entellus Monkey and Negro Monkey belong to this genus, and there are numerous species. (*See* MONKEY.)

SEMPERVIVUM. (*See* HOUSE LEEK.)

SENECIO, *sen-e'-she-o.*—In Botany, Groundsel, a genus of the natural order *Compositæ*, consisting of numerous species, natives of all parts of the world. The common groundsel, *S. vulgaris*, which is sold about the streets as food for cage-birds, is the best-known species. It was formerly much employed in the form of a poultice as a domestic remedy for spitting of blood.

SENEGA, OR SNAKE-ROOT. (*See* POLYGALA.)

SENNA. (*See* CASSIA.)

SENSATION, *sen-sai'-shun* (Lat., *sentio*, I perceive).—In Philosophy and Physiology, is the mental impression, feeling, or state of consciousness resulting from the action of external things on some part of the body, said, on that account, to be sensitive. The sensations are classified according to the bodily organs concerned in their production. Thus, we have sight by the eye, hearing by the ear, touch by the skin, smell by the nose, and taste by the mouth. The difference of the mental feeling or consciousness in the various senses is very strongly marked, so that we never confound a taste with a sound, or a touch with a smell. In addition to these, physiologists commonly distinguish a sixth sense, of a more vague character, under the title of common or general sensibility, including the several feelings of pleasure and pain, comfort and discomfort, warmth, chilliness, hunger and thirst, &c. An important subject connected with our senses is their education. "Our senses have to be educated—*i.e.*, to be drawn out, developed. We have to learn to see, to hear, and to touch." "Many hundred repetitions are necessary before what we call a sensation (*i.e.*, a distinct feeling, corresponding to that which the object will always produce upon the developed sense) can be produced. Many sensations are necessary to produce a perception: a perception is a cluster of sensations with an ideal element added. On the educated sense, objects act so as instantaneously to produce what we call their sensations; on the uneducated sense they act only so as to produce a vague impression, which becomes more and more definite by repetition."—(*G. H. Lewes.*) The effects of education upon the senses are seen in the acute taste of the wine or tea-taster, the hearing of the musician, the touch of the pianist, &c.

SENSES. (*See* SENSATION.)

SENSITIVE PLANT.—A name often given to certain species of the *Mimoseæ* (*see* MIMOSEÆ) because their leaves collapse or shrink together when touched.

SEPAL. (*See* CALYX.)

SERIES, *se'-reez* (Lat.).—A term used in Chemistry. The first chemist who arranged organic substances in series, whose numbers differed by equal increments or decrements of carbon, hydrogen, or oxygen, was Dr. James Schiel, of St. Louis, in the United States, although the credit of having originated this important method of classifying organic compounds is generally given to Gerhardt. It would be impossible to give a list of all the series which have been established of late years in organic chemistry: the most important of them will be found under HOMOLOGOUS SERIES.

SEROUS FLUIDS, AND SEROUS MEMBRANES. (*See* ANATOMY.)

SERPENTARY. (*See* ARISTOLOCHIACEÆ.)

SERPENTINE, *ser'-pen-tine.*—In Mineralogy, a hydrated silicate of magnesia, found in compact masses, tinged with black, red, and green spots. It takes a high polish, and is coming into very general use for ornamental purposes. It is found chiefly in Cornwall, where there are several extensively-worked mines. It takes its name from the resemblance it bears to the skin of certain serpents. The rougher portions are used as a source of the salts of magnesia.

SERPENTS, *ser'-pents* (Lat., *serpens*, creeping).—The third order of reptiles, of Cuvier, is thus named; and as they are without feet, they are more deserving of the name of reptiles than any other order. The general form of a serpent consists of a head, a body, and a tail, in one lengthened bone, without any extremities, though there are sometimes membranes to the head or neck, which admit of being inflated at the pleasure of the animal. The skeleton is simple in them, consisting chiefly of the skull, the spinal column, and the bones of the head. The skull is small, and the brain is also small, and very imperfectly developed, a fact which renders naturalists averse to the idea that the serpent is a good emblem of cunning or wisdom. The mouth is in every case merely a prehensile instrument, and not a killing or even wounding one; for, although the stroke of the poison-fang of a serpent is often of the most deadly character, it is only so through the poison which it discharges. The teeth of serpents are adapted for piercing and holding, but not for dividing or bruising; and consequently the animals belonging to this order swallow their prey whole; the jaws of serpents being united by ligaments, a conformation which gives them the power of dilating their jaws to such an extent as to swallow bodies larger than themselves. The serpents, with one exception (the *Deirodon*, which feeds on the eggs of birds), subsist on living prey, and, whether venomous or non-venomous, have their teeth, as might be expected, admirably constructed and arranged for the purpose of securing their prey and assisting in deglutition. The trachea of the serpents is very long; their heart situated very far backwards, and the greater number have only one very long lung, with a vestige of a second. The tongue has great powers of mobility and extension, and terminates in two cartilaginous points. The skin in different genera is annulated, coriaceous, or granulated, or most frequently covered with scales. The powers of digestion are so slow that one meal, in many cases, serves for weeks or even for months. The structure of the vertebral column of the serpents is different from that of any other animal; the most perfect specimens being found in the great crushing serpents which kill their prey by compressing it in their folds, and so constructed as to give them the fullest latitude of action. The shell of the egg in the oviparous serpents is soft, like the eggs of the common hen when she has not enough calcareous aliment; are often more than thirty in number, and are connected by a sort of viscous matter, which coagulates and joins them in a kind of chain. The surface of the brain of serpents is nearly smooth and without sinuosities or circumvolutions. Their organs of touch, taste, smell, and hearing appear to be dull, if not defective, whilst that of sight is sufficiently acute. Serpents can creep, glide, grasp, suspend themselves, erect themselves, leap, dart, bound, swim, and dive. Cold latitudes do not agree with them; it is in warm climates that their numbers, their venom, and their volume, attain their maximum.

Different kinds of Serpents.—Serpents are divided into venomous and non-venomous; and the former are divided again into venomous with many maxillary teeth and venomous with isolated fangs. In the non-venomous, the branches of the upper jaws are furnished throughout their length, as well as those of the lower jaw and of the palatine branches, with fixed teeth, which are not pierced. The venomous serpents with isolated fangs present a very peculiar structure in their organs of manducation. Their superior maxillary bones are very small, carried on a long pedicle, analogous to the external pterygoid apophysis of the spheroid bone, and very movable. Here is fixed a pointed tooth, pierced with a small canal, which gives issue to a liquor secreted by a considerable gland situated under the eye. It is this liquor which, when shed into the wound made by the bite of the serpent, produces effects more or less fatal, according to the species which has inflicted the wound. The fang is concealed in a fold of the gum when the serpent does not wish to use it; and there are behind it many germs destined to fix themselves in their turn, in order to replace it if it should be broken in the wound it makes. In the non-venomous, the branches of the upper jaw are furnished throughout their length, as well as those of the lower jaw and the palatine branches, with fixed teeth which are not pierced; there, are, therefore, four nearly equal rows of these teeth in the upper part of the mouth and two in the lower. All the venomous species bring forth their young alive, in consequence of the egg being hatched internally before it is laid; whence their general name of vipers, a contraction of vivipares. The venomous serpents with many maxillary teeth have the jaws organized and armed nearly as in the non-venomous; but the species have the first of their maxillary teeth greater than the others, and pierced so as to conduct the venom in the same manner as is effected in the venomous serpents with isolated fangs.

SERPULA, *ser'-pu-la.*—A genus of marine creatures belonging to the *Annelida* (which *see*) They form and inhabit a shell in the shape of a tube, which shell they often attach to other shells or rocks in the sea. There are several species, some of which are found on British coasts, but the largest exists in tropical seas, where they attach themselves to coral reefs and form most beautiful objects.

SERTULARIA, *ser-tu-lay'-ri-a.*—A very beautiful genus of Zoophytes (*Anthozoa*) of which there are several species. Some are found on British coasts, where they attach themselves to sea-weed, stones and shells. In form they are branched and plant-like. (*See* ZOOPHYTES.)

SERVAL, *ser'-val.*—A sort of large wild-cat, found in South Africa, where it is known as the Bush Cat. Its fur is very beautiful, and is spoken of by furriers, as Tiger Cat fur.

SERVICE.—A name sometimes given to the *Pyrus* or *Sorbus domestica* of botanists. It is a tree of about fifty or sixty feet high, with pinnate leaves, and bears fruit something like a small pear. The Wild Service (*Pyrus torminalis*) is a much smaller tree, but otherwise somewhat similar in character.

SESAMUM, *se'-sa-mum.*—In Botany, a genus of the natural order *Pedaliaceæ*. *S. orientale* has oily seeds, which yield by expression the product known in India as teel, gingely, or gingillie oil. It is rarely imported, as it soon becomes rancid; but it is said to be largely employed for adulterating almond-oil.

SESSILE.—A leaf without a stalk. (*See* LEAF.)

SETARIA, *se-tai'-re-a.*—In Botany, a genus of the natural order *Graminaceæ*. *S. germanica* and *italica* yield respectively German and Italian millet, varieties of grain which are largely used as food.

SETON, *see'-ton.*—In Surgery, an opening into the flesh produced and kept open by artificial means, such as a skein of silk or cotton, to excite suppuration. The principal use of Setons are to drain the system, as in head affections, or to act as counter irritants.

SETTER, *set'-ter.*—A mongrel dog (*Canis familiaris Index*) produced by crossing, chiefly between spaniels and pointers. The principal varieties of the setter are the English and the Irish. The English setter does not differ from the pointer, but is more loosely made, so as to admit of more rapidity of motion, with less diminution of the continuance of that motion. It is equalled by few hunting dogs in sagacity, and excelled by none in docility and personal attachment. In colour it may be met with of almost every tint and marking common to hounds and spaniels, but the colour has little to do with its qualities, although the contrary is frequently asserted. Their hair is, in general, beautifully curled. The habits of the setter and the pointer are much the same (*see* POINTER); but its cheerful obedience, extreme hardihood under exertion, and quickness, render it, under certain circumstances, more valuable than the pointer to the sportsman. The hairy protection of the setter's feet enables it to go through a long day's journey over moss and moor without injury, whereas most pointers would be knocked up. On the other hand, the setter, in most cases, requires more breaking than the pointer. As it too frequently happens that its enthusiasm leads it to forget the instructions it has received, a small amount of re-breaking is often required before the shooting of each season commences. The Irish setter dog is a large red dog, of very commanding mien, great powers and excellent sporting qualities.

SEXES, LAW OF THE PRODUCTION OF THE.—Professor Thury of Geneva has put forth a theory, supported by a whole series of reasonings, as to the deduction of the "law of the sexes." The study of plants, in which external agents duly managed enable the observer to instigate the development of either the one or the other sex, and the results obtained by these experiments, seem to prove that the development of the male sex is always related to those general causes which induce a more complete maturation of the juices, and a more perfect development of the organs.

Professor Thury's Reasoning may be thus summarized:—1. Sex depends on the degree of maturation of the ovum at the moment of its fecundation. 2. The ovum which has not attained a certain degree of maturation, if it be fecundated, produces a female; when this degree of maturation is passed, the ovum, if fecundated, produces a male. 3. When, at the rutting season, a single ovum separates from the ovary to descend slowly the genital canal (as in uniparous animals), it is sufficient that the fecundation takes place at the commencement of the rutting season to produce females, and at the end to produce males, the turning-point of the ovum occurring normally during its passage in the genital canal. 4. When several ova separate successively from the ovary during a single generative period (multiparous and oviparous animals in general), the first ova are the last developed, and produce females; the last are more mature, and produce males. But if it happens that a second generative period succeeds the first one, or if the external or organic conditions change considerably, the last ova may not attain to the superior degree of maturation, and may again furnish females. *Cæteris paribus*, the application of the principle of sexuality is less easy in the case of multiparous animals. 5. In the application of the above principles to the larger mammalia, it is necessary that the experimenter should first of all observe the course of the phenomena of heat in the very individual upon which he proposes to act, in order that he may know exactly the duration and the signs of the rutting season, which frequently vary in different individuals. 6. It is evident that no certain result can be expected when the signs of heat are vague or equivocal. This is scarcely ever the case in animals living in a state of freedom; but cattle in the fattening sheds or in the stable present this abnormal peculiarity. Such animals must be excluded from experimentation. From the mode in which the law ruling the production of the sexes has been deduced, it results that this law must be general, and apply to all organized beings; that is to say, to plants, animals, and man. It is necessary to distinguish carefully the law itself (1 and 2 of this summary), which is absolute, from the applications of it, which may be made with more or less facility. M. George Cornaz, a distinguished agriculturist in the Canton de Vaud, received in 1861 certain confidential instructions from Professor Thury, the object of which was an experimental verification of the law which governs the production of sex in animals. Accordingly M. Cornaz applied in his management of a herd of cows possessed by him the data furnished by Professor Thury, and obtained at once, without any uncertainty, all the expected results. He made in all twenty-nine experiments according to the new process, and all gave the desired result, male or female. He met with no cases of non-success. All the experiments were made by himself without the intervention of any other person; consequently, he declares his belief that the method of Professor Thury is sound in theory and certain in practice, and he hopes that it will soon profit all breeders and agriculturists.

SEXTANT, *seks'-tant* (Lat., *sextans*, a sixth).—An instrument principally used at sea for measuring the altitudes of heavenly bodies, and ascertaining their apparent angular distance. It is constructed on a similar principle to that of the quadrant; but the arc, containing the sixth part of a circle, may be taken to 120°. A sextant is generally fitted with apparatus for ascertaining the angular distances, &c., in lunar observations.

SHAD.—A species of fish something like a large herring; thus the Scottish fishermen call a shad the King of the Herring.

SHAD-BERRY. (*See* AMELANCHIER.)

SHADDOCK. (*See* CITRUS.)

SHAGREEN, *sha-green'*.—Commonly supposed to mean sharks' skin dressed and dried into a kind of leather (*see* SHARK); but a great deal of Oriental shagreen is really the skin of camels, oxen, or horses, &c., prepared in a peculiar way, so that its surface may be covered with a number of small elevations.

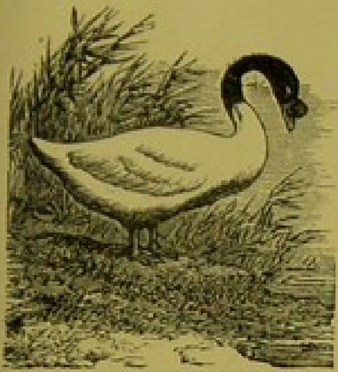
SHALE OILS, *shail*.—Mineral oils found in shale or slate-clay. At Rangoon and several other localities in Burmah, naphtha is obtained from a pale blue clay soaked with oil, which rests upon roofing-slate, beneath which is coal containing iron pyrites. Messrs. De la Rue and H. Müller have made the petroleum from this locality the subject of examination. It is obtained by sinking wells about sixty feet deep, in which the liquid is collected as it oozes from the soil. At ordinary temperatures it has the consistence of goose fat; it is lighter than water, and has usually a greenish-brown colour, and a slight and peculiar, but not unpleasant, odour. The term is also applied to the oils distilled from bituminous shale found in the island of Portland and other localities. (*See* OIL WELLS.)

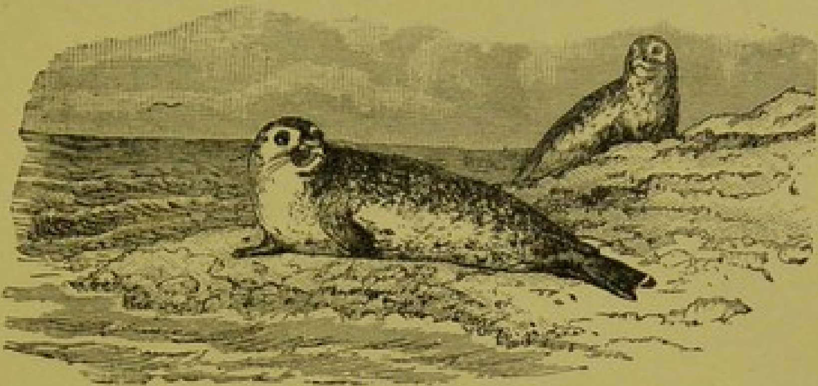
SHALLOT. (*See* ALLIUM.)

SHAMROCK, *sham'-rok* (Irish).—In Botany, a ternate-leaved plant, adopted by the Irish as their national emblem. Many and warm have been the disputes to determine the veritable shamrock. Some writers contend for the *Oxalis acetosella*, or wood-sorrel, the leaves of which unfold about St. Patrick's day; while others maintain that the *Trifolium repens*, or white clover, is the favoured plant. Legends make out that St. Patrick, when preaching the gospel to the benighted inhabitants of Ireland, illustrated the great doctrine of the Trinity by the triple leaf of the shamrock. Whether he plucked the bright green leaf of the wood-sorrel, or the more familiar herbage of the white clover, cannot now be determined. The latter is, however, now generally worn by enthusiastic Irishmen on St. Patrick's day.

SHARK, *shark* (*Squalus*).—A family of cartilaginous fishes allied to the rays, but easily distinguished from them by the peculiar rhomboidal form of the latter. In the shark the form of the body is elongated, and the tail thick and fleshy. The muzzle is rounded or pointed, depressed, and projects over the mouth, which is large, and armed with several rows of compressed, sharp-edged, and sometimes serrated teeth. The nostrils are situated on the under side of the muzzle, in the form of oblique openings, which vary somewhat in figure according to the species. The fins generally consist of two dorsals, two large pectorals, two ventrals, an anal fin, and a caudal. The portion of the tail of the shark which supports the tail fin is almost always bent upwards at an obtuse angle with the body. The water penetrates to the gills by means of several transverse openings, which are situated on each side of the neck. The skeleton is usually cartilaginous. The skin is usually very rough, covered with a multitude of little osseous tubercles; and that of some species forms a substance called shagreen. The eggs of the shark are fine and large in comparison with those of bony fishes, and are enveloped in a hard, horny, semi-transparent shell, terminated at the four angles with long filaments. These are deposited by the parent shark near the shore in the winter months. The convoluted tendrils hanging to the sea-weed, or other fixed bodies, prevent the cases being washed away into deep water. Two elongated fissures at each end allow the admission of sea-water; and the young fish ultimately escapes by an opening at the end, near which the head is situated. A curious peculiarity has been observed in the young of the shark during a very early stage of their existence. From each of the branchial apertures branchial filaments project externally; each filament contains a single minute reflected vessel, in which the blood is then submitted to the action of the surrounding medium. The appendages are only temporary, and the blood of the fish is afterwards aërated by the true gills. Sharks are the most formidable and voracious of all fishes, pursue all other marine animals, and seem to care little whether their prey be living or dead. They often follow vessels for the sake of picking up any offal which may be thrown overboard, and man himself often becomes a victim to their voracity. The teeth of the shark are movable at the will of the animal, and are usually laid down and directed backwards, but become erect at the moment the animal is seizing its prey. They are arranged in several series, one within the other, of which the outermost row is that in use; the other rows serving to replace the foremost when injured. Their form varies much in the different species, and even those of the upper and lower jaw are often very dissimilar; but although thus variable, they most commonly exhibit modifications of a triangular form, are sharply pointed, and have the lateral edges sharp and frequently serrated. Yet terrible as these teeth are, and well as they are fitted for inflicting the most fearful lacerations, their chief action is seizing and swallowing, not killing and dividing their prey. As is the case in fishes generally, the stomach of the shark, is fitted for performing the whole work of assimilation without any preparation of the food by the mouth, and if it can be obtained without a struggle, the largest prey that the shark can swallow goes to the stomach entire. Large fishes, seals, the bodies of various animals of considerable size, and even an entire human body, have been found whole in the maws of the more formidable specimens of the shark family. The sharks form several natural genera, distinguished by the presence or absence of blow-holes, or of the anal fin; by the form of the head, nose, teeth, &c.

The Basking Shark (*Squalus maximus*).—So called from its habit of remaining occasionally at the surface of the water almost motionless, as if enjoying the influence of the sun's rays, is one of the largest of the true fishes, and has been known to measure thirty-six feet in length. From the month of June to the commencement of winter, it is to be found on various parts of the coasts of Great Britain and Ireland, and frequently wanders from our southern coast as far to the eastward and south as the coast of France. It is said to exhibit but little of the ferocious character of


BLACK-NECKED SWAN.


SEAL.


SCAPULA, OR SHOULDER BLADE.


SYCAMORE.


SUGAR CANE.


SILKWORM AND MOTH.


STAGHOUND.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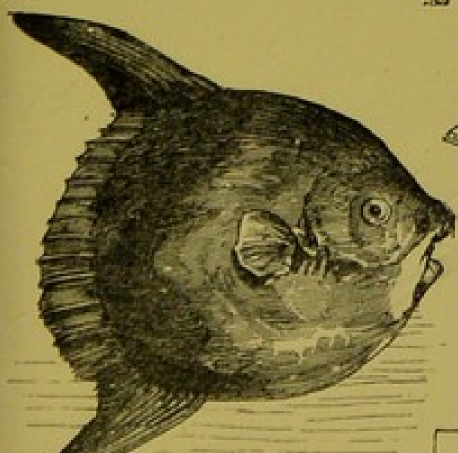
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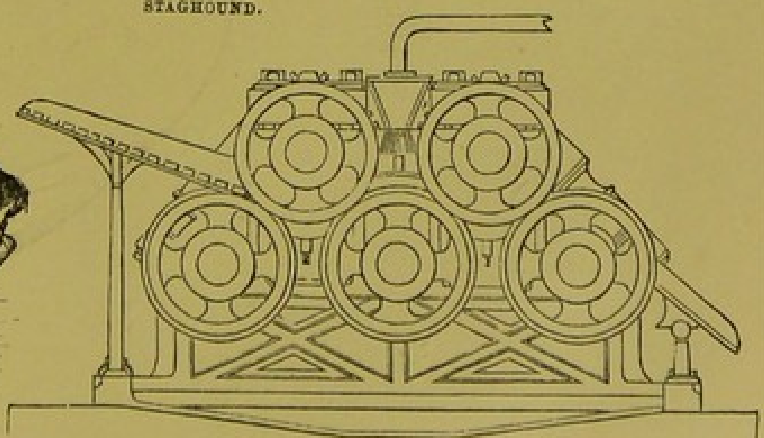

SUGAR MILL.

the sharks in general, and to have the smallest teeth in proportion to its size of any of them.

The White Shark (*S. Carcharias*).—An inhabitant of most quarters of the globe, though preferring the warmer to the colder latitudes, and of all the species is one of the largest and most voracious.

The Hammer-headed Shark (*Zygæna malleus*).—One of the most strange in form of the whole class of fishes, its head being dilated to a great extent on each side, in the form of a double-headed hammer: the eyes, which are very large, being placed on each side. It is said to be extremely ferocious, to frequent deep water, and to measure from seven to eight feet in length. It is found in the Mediterranean, on the shores of the various countries of Europe, in the ocean, and on the coast of Brazil.

The Blue Shark (*Carcharias glaucus*).—An inhabitant of the Mediterranean, but frequently visits several parts of our coasts, and being very bold and voracious, inflicts great injury on our fishermen, cutting their lines and nets, and sometimes passing along the whole length of a pilchard drift-net, cutting out, as with shears, the fish and the net that holds them, and swallowing both together. It is of a slender and elegant shape, and its colour, which is blue-green above and white beneath, is particularly handsome.

The Spinous Shark (*Echinorhinus spinosus*).—So called from having the surface of the skin, both on the body and fins, more or less sprinkled with strong bony-looking spines, with large circular and flattened bases, which vary in size as well as in form, some being hooked, others quite straight, in some places disposed clusters, in others solitary, and on the extremity of the muzzle nearly wanting.

The Greenland Shark (*Scymnus borealis*).—A native of the northern seas, and is one of the foes of the whale, which it bites and annoys while living, and feeds on when dead. It attains a length of twelve or fifteen feet, and a circumference of six or eight. It appears almost insensible to pain, and its body, though separated into any number of parts, gives evidence of life for several hours.

SHAVE GRASS. (*See* EQUISETACEÆ.)

SHEARWATER, *sheer'-wa-ter.*—A genus (*Puffinus*), sometimes called skimmer, of marine birds, the *Procellaridæ*, different, however, from the Petrels, in that the tip of the lower mandible is curved downwards, and the nostrils are separate and do not open by a common tube. The shearwaters live almost always on the ocean. (*See* PETREL.)

SHEATH-BILL, *sheeth'-bill.*—A genus of birds (*Chionidæ*) having stout legs and toes much like those of a common fowl; bill thick and conical and covered with a horny sheath. The White Sheath Bill is found on the shores of Australia and New Zealand, where it feeds on molluscs, &c.

SHEEP, *sheep.*—Naturalists are by no means agreed as to what was the original breed of this invaluable animal (*Ovis Aries*), which is, in modern farming, almost equally important for furnishing the farmer with a dressing of manure and the community at large with mutton, clothing, and other necessaries of life.

Varieties of Sheep.—Of the several varieties of wild sheep which have by naturalists been considered entitled to the distinction of being the parent stock may be mentioned—1. the Musmon (*O. Musimon*), still found wild in the mountains of the larger islands of the Mediterranean and European Turkey; 2. the Argali (*O. Ammon*), or wild Asiatic sheep, which are the tenants of the highest mountains of central Asia, and the elevated inhospitable plains of its northern portions; 3. the Rocky Mountain sheep (*O. montana*), which is found on the mountains of North America; 4. the bearded sheep of Africa (*O. tragelophus*), found on the high lands of Egypt and in Barbary. The leading fact in the geographical history of this genus is, that it occurs both in the new and the old world, whereas the goat tribe are naturally unknown in America. It is usually regarded by naturalists as being not only specifically but generically distinguished from the goat tribe; but some authorities, on the other hand, are inclined to believe that the generic separation is founded chiefly upon characters which have arisen from the influential power of man. In a state of nature the sheep is scarcely less active or energetic than the goat; its dimensions are greater, its muscular strength at least equal both in force and duration. It is also an Alpine animal, and amongst its native fastnesses bounds from rock to rock with almost inconceivable swiftness and agility. The main characteristics of the four unsubdued races of sheep mentioned above are as follows:—

The Musmon measures about three feet and a half in length, and its height at the highest part of the back is about two feet six inches. The neck is large, the body thick, muscular, and of a rounded form. The limbs are robust and the hoofs short. The horns of the male are nearly two feet long. The body is protected by a short, fine, gray-coloured wool, of which the filaments are spirally twisted, and by a stiffish silky hair, of no great length, yet sufficient to conceal the wool beneath. It is gregarious in a state of nature, and seldom descends from the highly-elevated portions of the mountains on which it dwells. The general opinion of naturalists is that it is from this species that we have obtained our domestic breeds.

The Bearded Sheep of Africa has the hair on the lower part of the cheeks and upper jaws extremely long, so that it forms a double or divided beard. The hairs on the sides and body are short, those on the top of the neck somewhat longer, and rather erect. The whole under parts of the neck and shoulders are covered by coarse hair, not less than fourteen inches long; and beneath the hair, on every part, there is a short genuine wool, the rudiments of a fleecy clothing. The tail is very short; the horns, which are about two feet long, approach each other at their base, and diverge outwards.

The Argali, or Wild Sheep of Asia, measures about three feet in height at the shoulder, and five feet in length. His horns are nearly four feet long, and placed on the summit of the head, so as to cover the occiput. They nearly touch each other in front, bending backwards and laterally, and then forwards and outwards. The female is of smaller size, and her horns are nearly straight. The name of *Argali*, applied to this species, is the Mongali name of the female; the male is called *Guldschah*.

The Ovis Montana, or Rocky Mountain Sheep of America, is larger than the largest varieties of our domestic breeds. The horns of the male are of great dimensions, arising a short way above the eyes, and occupying almost the entire space between the ears, but without touching each other at their bases. The hair in this species resembles that of a deer, and is short, dry, and flexible in its autumn growth, but becomes coarse, dry, and brittle as the winter advances.

Sheep in Britain.—It is doubtful whether sheep are indigenous to this country, but they are mentioned as existing in Britain at a very early period, and it is known that the Romans, during their occupation of it, established a woollen manufactory at Winchester. The many varieties of sheep which tenant Great Britain and Ireland may be conveniently divided into two classes; the first consisting of sheep without horns, and the second of sheep with horns. Of the first class are—

The New Leicester Sheep, the characteristics of which are fineness and fulness of form; in the same apparent dimensions, greater weight than any other sheep; and early maturity and a propensity to fatten, a diminution in the proportion of offal, and the return of most money for the quantity of food consumed; the wool not so long as in some breeds, but considerably finer.

The Cotswold Sheep, which have been long celebrated for the fineness of their wool, and which have been gradually improved by crossing with the Leicester sheep. It is this half-bred Leicester and Cotswold sheep which now chiefly tenants the Gloucestershire and Worcestershire farms. Their mutton is fine-grained and full-sized.

The Dartmoor Sheep, which have white faces and legs, some with and some without horns, small in the head and neck, and generally small-boned, carcase narrow and flat-sided.

The South-Down Sheep, which takes its name from a tract of down extending more than sixty miles in length through part of the counties of Sussex, Surrey, and Kent. The wool is short, close, and curled, and free from spiry projecting hairs. The flesh is finely grained and of good flavour. The breed has been much improved during the last few years, not from crossing with other breeds, but by the system of sorting the flocks.

The Romney-Marsh Sheep, which have long but coarse wool, much internal fat, and much hardihood, and require no artificial food during the hardest winter but a little hay.

The Cheviot Sheep are a peculiar breed which are kept on the extensive range of the Cheviot hills. They have the face and legs generally white, and the body long; their wool is short, thick, and fine; they possess very considerable fattening qualities, and can endure much hardship both from starvation and cold.

Of the Horned Sheep, the chief varieties are:—The *Dorset sheep*, which are principally bred within a circle of twelve miles round Dorchester. They are a good folding sheep, and their mutton is well-flavoured, but their principal distinction and value is the forwardness of the ewes, who take the ram at a much earlier period of the year than any other species, and thus supply the market with lamb at the time when it fetches the highest price.

The Norfolk Sheep (now nearly extinct), a peculiar variety of heath sheep, which has been found in the localities of Norfolk and Suffolk from time immemorial. Their peculiar characteristics give them a greater resemblance to the deer than has been observed in any other species.

The Merino Sheep, which was introduced into England by George III. from Spain, and which may now be considered to be acclimatised to a certain extent; but as it was ascertained that though the fleece of the Merino did not much degenerate in England, it did not much improve, and the carcass, which naturally affords little weight of meat, did not improve, our farmers have found it to their interest to return to their native breeds, and to give up the Spanish sheep.

The Irish Sheep were formerly ugly and ill-formed, but have been much improved by the importation of English rams.

The Shetland Sheep are small and handsome; hornless, hardy, feeding on even sea-weed, and with soft and cottony wool.

The Hebridean Sheep is the smallest of its kind, even when fat weighing only twenty pounds.

The Fat-tailed Sheep, common in Tartary, Arabia, Persia, and Egypt, the tail of which is so loaded with fat that it alone frequently equals in weight the whole carcass of an Hebridean sheep.

The Many-horned Sheep of Iceland and the most northern part of the Russian dominions, which has three, four, or five horns, sometimes placed with great regularity, and sometimes differing in proportion and situation.

The Cretan Sheep, chiefly found in the island of Crete, but kept in many parts of Europe on account of the strangeness of the appearance of its horns, which are remarkably large, long, and spiral; those of the male being upright, and those of the female at right angles to the head.

The Fat-rumped tailless sheep, met with in all the deserts of Tartary, and which have long legs, a somewhat arched visage, horns, in the male, like those of the domestic sheep, large pendent ears, and a tail so enveloped in fat as to be scarcely visible.

The African or Guinea sheep, a native of all the tropical climates, both of Africa and the East. Its distinguishing characteristics are: a rough hairy skin, short horns, pendulous ears, a kind of dewlap under its chin, and a long mane which reaches below the neck. Different names are given to the sheep in this country, according to its sex and age. The male is called a *ram* or *tup*. After weaning, he is said to be a *hog*, *hogget*, or *hoggerel*, a *lamb hog* or *tup hog*, or *teg*; and if castrated, a *wether hog*. After shearing, he is called a *shear hog* or *shearing*, or *dinmont* or *tup*. After the second shearing, he is a *two-shear ram*; and so on. The female is a *ewe* or *gimmer lamb* till weaned, and then a *gimmer* or *ewe hog*, or *teg*. After being shorn, she is a *shearing ewe* or *gimmer*, or *theave* or *double-toothed ewe*; and after that a *two*, or *three*, or *four shear ewe*, or *theave*. The age of the sheep is reckoned, not from the period of their being dropped, but from the first shearing.

Sheep Dog (*Canis familiaris domesticus*).—The shepherd's dog, which is probably the most extensively diffused of the race of dogs, everywhere preserves some personal characteristics which mark his adherence to the original type. One of these is his quantity of covering, which is in every case great, particularly about the neck: in temperate climates his coat is frequently long and shaggy, in cold ones coarse and crisped, in arid regions long and shaggy but fine. In England, there are two varieties, the one smooth, short-haired, generally black-coloured on the back, white on the belly, breast, feet, and tip of the tail, with tan-coloured spots on the face and legs: the other being a larger animal, with long hair of different colours, and long flowing tail. The former is sagacious, slow, easily broke and trained, and well suited to work in an enclosed and low country, such as that in which graze the Leicester sheep; whilst the latter are more suited to the country of the Cheviot and black-faced sheep. The sheep-dog of Scotland, known as a "colly," is smaller than either of those above mentioned, and has a more pointed face. The shepherd's dog is asserted by the best authorities to be the least removed from the natural type of the dog, and to live and maintain its proper characteristics while other races often degenerate.

SHEPHERD'S DOG. (*See* SHEEP DOG.)

SHELL, in Natural History. (*See* MOLLUSCA.)

SHELLDRAKE, OR SHIELDRAKE.—The name given to a genus of ducks (*Tadorna*) which form a connecting link between the geese and ducks. The common shelldrake is found on the sandy shores of Britain, though other species are mostly natives of the southern hemisphere. They belong to that section of the duck family which have the hind-toe without any pendent membrane. (*See* also DUCK.)

SHOLA, *sho'-la*.—The white pith of an East Indian plant, *Æschynomene Aspera*. It is largely used in making hats, which being light and cool, are yet capable of defending the head from the heat of the sun. British troops in India often have helmets made of this material.

SHOOTING STARS. (*See* FALLING STARS.)

SHOREA, *sho'-re-a*.—In Botany, a genus of large trees, belonging to the natural order *Dipteraceæ*. The most important species is *S. robusta*, a native of India, which furnishes the valuable timber known by the name of *sal*. It also yields a balsamic resin, called *ral*, *dhoona*, or *dammar-pitch*, which is employed for incense.

SHORT-SIGHT. (*See* SIGHT.)

SHOVELLER, *shuv'-el-ler*.—A genus of ducks (*Rhynchaspis*), not common in Britain, and usually only winter visitants, though some have been seen in the summer. They belong to that section of the duck family which have no pendent membrane on the hind toe, their chief characteristic being, however, the expansion of the end of the bill in the adult birds. (*See* DUCK.)

SHREW, *shroo'*.—A genus of small animals (*Sorex*), something like rats, but having a long head and snout, and insectivorous, not rodent teeth. Shrews are found in dry fields, hedge banks, and gardens.

Shrew Mole.—A genus of small mammalia (*Scalops*), nearly allied to the moles in habit and appearance. They belong to the family *Talpidæ*, and have 6 incisors, 2 canine teeth, 8 false and 6 true molars in each jaw. (*See* MOLE.)

SHRIKE. (*See* BUTCHER-BIRD.)

SHRIMP, *shrimp.*—A small crustaceous animal (*Crangon vulgaris*) allied to the lobster and craw-fish, which frequents shallow waters along the sea-coast. In shape, it resembles those animals, but is much more elongated in proportion, and is destitute of the large anterior claws, and it is distinguished from the prawn by the absence of the long anterior serrated spine. The shrimp has ten feet; the tail is as long as the body, and terminated at the extremity with scale-like appendages, which unfold somewhat in the manner of a fan. Whilst alive, the body is of a greenish-gray colour, dotted with brown, and semi-transparent. It is common on the coasts of England and France, and is one of the most delicious of the macrurous crustaceans. The shoals of these creatures which frequent our shores give employment to a great number of persons, who are employed in catching them. They are abundant at the mouth of the Thames, whence the London market is chiefly supplied. They are caught by a large open net, which is attached to a long stick, and pushed through the water.

SHRUB, *shrub.*—The name commonly given to a plant having a woody stem and branches like trees. Shrubs are not so high as trees, and the branches grow out near the root. In Law, whoever plants a shrub makes it part of the soil, and a tenant cannot remove it, as it is regarded as a kind of fixture. This does not apply to market gardeners, however.

SIALOGOGUES, *si'-al-o-gogs.*—The name given to various substances (of which the Pellitory root is perhaps the best) which increase the secretion of saliva. This they do by their stimulating action on those parts. (*See* SALIVA.)

SIDEREAL, *si-de'-re-al* (Lat., *sidus*, a constellation).—A term used in Astronomy in order to distinguish that which has reference to the fixed stars from that which relates to the sun, moon, planets, or comets. Thus a sidereal day is the time during which the whole body of fixed stars appears to revolve round the earth. It is found by observing two successive passages of the same star over the meridian. The time for one passage to another consists of twenty hours, each of sixty minutes, each of sixty seconds, &c. Sidereal time is not suited for the purposes of every-day life; but on account of its uniformity, it is very useful in astronomical observations.

Sidereal Clock.—A clock used by astronomers for ascertaining the sidereal time. The sidereal day, and of course each subdivision of it, is shorter than the solar day, because the sidereal time is determined simply by the rotation of the earth on its axis, and the day is completed as soon as this rotation is performed; but in the case of the solar day, the earth's revolution round the sun also requires to be taken into account. Every day the earth advances in its orbit nearly a degree; and to bring the sun to any particular meridian, it has to make so much more than a complete rotation on its axis as will counterbalance its advance in its orbit. The average amount of this daily advance is 59' 8". The mean solar day is 24 hours, 3 minutes, 56 seconds, sidereal time; or the sidereal day is 23 hours, 56 minutes, 4 seconds, mean solar time.

SIGHT, *site* (*i.e.*, the faculty of seeing).—In Physiology, one of the five senses, having for its organ the eye. (*See* EYE.) In this organ we have the retina, an expansion of the optic nerve, to receive and transmit to the brain the impressions of light; certain refracting media for so disposing the rays of light traversing them as to throw a correct image of an external body on the retina; and a contracting diaphragm, with a central aperture for regulating the quantity of light admitted into the eye. When the eye is directed to any object, an image of that object is depicted on the back of the eye by means of the rays of light entering the pupil, and duly refracted by the different humours. The image, which is inverted, produces, somehow, an impression upon the retina with the assistance of the choroid coat, and this impression passes inwards to the nervous centres, whence the optic nerve takes its rise. No satisfactory explanation has yet been given to account for the fact that we see objects erect the images of which are presented to us inverted on the retina. According to Müller, the mind really perceives the objects inverted; but as this inversion is uniform, it is not perceived. The eye is educated slowly, and if educated fully, its powers are almost boundless. The great majority of mankind do not and cannot see one fraction of what they were intended to see. The sailor on the look-out can see a ship where the landsman sees nothing; the Esquimaux can distinguish a white fox amidst the white snow; and the shepherd can distinguish the face of every sheep in his flock. Truly "the eye sees what it brings the power to see." The subject of binocular vision, or that with two eyes we only perceive one object, was long a perplexing subject to philosophers, until it was satisfactorily explained by Professor Wheatstone in 1838, and illustrated by means of that now well-known instrument the stereoscope. The power of adapting the eye to vision at different distances has received the most varied explanations; but the opinion now generally entertained is that it depends mainly on some alteration, either in position or form, which takes place in the crystalline lens. Some persons possess this power of adaptation in a very slight degree, and thus labour under defective vision, of which there are two kinds, the person in the one case only seeing distinctly those objects which are near, in the other, only such as are distant.

Near-Sight, Short-Sight, or Myopia, is caused by anything—such as undue convexity of the cornea—which increases the refracting power of the eye, and so causes the image of an object to be formed at a point anterior to the retina, and is remedied by the use of concave glasses.

Long-sightedness is owing to conditions the reverse of this, and is remedied by the use of convex glasses, which diminish the focal distance of an image formed in the eye. In this distinctness of sight the following conditions are necessary:—(1) A sufficiency of light or illumination in the object viewed; (2) the formation of the image exactly on the retina, and not either before or behind; and (3) the minute size of the ultimate divisions of the retina capable of independent sensation. The great superiority of the eye as a medium for perceiving the outer world, lies in this power of independent sensibility to minute points. We judge of the motion of an object partly from the motion of its image over the surface of the retina, and partly from the motion of our eyes following it; and of the form of bodies, partly from the mere sensation, and partly from the association of ideas.

SIGNS OF THE ZODIAC. (*See* ZODIAC.)

SILENE, *si-lee'-nee.*—A genus of plants, of which there are numerous species, natives of the temperate Zone of the northern hemisphere, and belonging to the natural order *Caryophyllaceæ.* The most common species is the *Bladder Campion*, a perennial growing in cornfields and dry pastures. The flowers are useless, but are given by ignorant country people in weakness of every kind.

SILEX.—A name sometimes given to all minerals in which silica is found in large quantities.

SILICA. (*See* SILICON.)

Silica, also sometimes called *Silicio Acid* (Lat., *silex*, flint, because it constitutes the chief part of that substance), Si O_2.—Silica is oxide of Silicon, and is sometimes known as *Silicic Acid.* Pure silica occurs in nature, crystallized in six-sided prisms, terminated by six-sided pyramids in rock crystal and some other forms of quartz. It enters largely into the composition of agate, calcedony, flint, opal, sandstone, felspar, and a vast number of other minerals. In a perfectly pure state it is quite transparent and colourless. Its hardness is next to that of the precious stones, and it has a specific gravity of 2·6. It fuses in the oxy-hydrogen blow-pipe, and may be drawn into threads like glass. It is insoluble in water when anhydrous, and in all acids except the hydrofluoric. When heated alone, silica is not volatile, but when heated with water, it undergoes partial sublimation at a high temperature. Silica presents the general characters of an earthy base, but acts as an acid, forming with the bases compounds known as *silicates.* These are very abundant in nature; clay, felspar, mica, hornblende, and a large number of other common minerals, are compounds of this description. Silica may be obtained pure by fusing one part of finely-powdered quartz or sand in a platinum crucible, with 2½ parts of a mixture in equivalent proportions of the carbonate of potash and soda, the mineral being added to the fused mass from time to time, until the whole of the carbonic acid is driven off. The fused mass is allowed to cool, and is dissolved in very dilute hydrochloric acid, and filtered. It is then evaporated to dryness, and the residue is again heated with hydrochloric acid, and thrown on a filter, washed with hot water, dried, and ignited. In this state it forms a finely-divided gritty white powder, insoluble in water and acids, with the exception of hydrofluoric acid. It may be precipitated in a gelatinous form by the decomposition of fluoride of silica by water, being considerably soluble in that liquid. The history of the hydrates of silica is somewhat complicated. The industrial applications of silica are very numerous. Glass and pottery are compounds of silica, with various metallic oxides. It is extensively used in metallurgical operations, as a flux for effecting the decomposition of ores by the formation of a light glassy slag, which floats on the top of the molten metal, carrying with it the impurities contained in the mineral.

SILICON, *sil'-e-kon.*—In Chemistry, symbol Si, equiv. 28, was discovered by Berzelius in 1823, and was first supposed to be a metal, and received the name of silicium; but from its close analogy to carbon, and boron, it is now considered to be a non-metallic element. It is in the form of its only oxide silica, the most abundant solid element in nature. It is obtained in a state of purity by igniting the double fluoride of silicon and potassium with sufficient potassium to combine with the whole of the fluorine. The mass is then washed first with cold and then with hot water. Silicon thus obtained is known as *Amorphous silicon*, a dull brown powder sinking in water, in which it is insoluble. It soils the fingers when touched, is a non-conductor of electricity, and is insoluble in all acids but the hydrofluoric. Heated in oxygen or air, it burns with a brilliant flame, being converted into silica, its only oxide. If heated in a closed platinum crucible, its properties become changed. It is now insoluble in hydrofluoric acid, it is decreased in bulk, and may be heated strongly in air and oxygen without taking fire. Deville describes a kind of modification of silicon, which has the appearance of platinum filings. It is formed by acting with hydrochloric acid on silicide of aluminium, procured by electrolysis of the double silicide of sodium and aluminium. Silicon unites with hydrogen, forming a gas spontaneously inflammable in air or oxygen. It also forms compounds with sulphur, chlorine, bromine, fluorine, and one or two other elements; but they possess no practical interest.

SILICULA, *sil-ik'-u-la.*—In Botany, a kind of fruit resembling the Siliqua (which *see*) in every respect except its length, the silqua being long and narrow, the silicula broad and short. Examples occur in the shepherd's purse, the scurvy-grass, and other cruciferous plants.

SILIQUA, OR **SILIQUE**, *sil'-e-kwa* (Lat.).—In Botany, a superior one or two-celled, many-seeded, long, narrow fruit, dehiscing by two valves separating from below upwards, and having the seeds attached to two parietal placentas, which are commonly connected together by a spurious vertical dissepiment, called a replum. The placentas are opposite to the lobes of the stigma instead of alternate, as is the case in all fruits which are regular in structure. When the replum extends entirely across the fruit, the latter is said to be two-celled; when only partially, it is one-celled. Examples occur in the wallflower, stock, cabbage, and in many other plants of the natural order *Cruciferæ.* When a fruit possesses the general structure of the siliqua, but with the lobes of the stigma alternate with the placentas, as in the celandine, it is termed a *ceratium*, or *siliquiform capsule.* (*See* SILICULA.)

SILK WORM, *silk'-wurm.*—The ordinary name of the caterpillar of a lepidopterous insect belonging to the section *Nocturna* and family *Bombycidæ.* It was originally from China, and is of a white or cream colour, with a brown fascia, and two or more waved lines of a deeper colour crossing the wings. In this country, the eggs of this moth hatch early in May. The caterpillar silkworm is at first of a dark colour, but soon becomes light, and in its tints much resembles the perfect insect. Its proper food is the mulberry, though it will sometimes eat the lettuce and some few other plants. The silkworm is about eight weeks in arriving at maturity, during which period it changes its skin four or five times. For about three days before casting its skin, it is lethargic, refusing its food. On the termination of this period, the old skin opens at the anterior end, the fore legs are disengaged, and the new and delicately-attired worm escapes forth. Immediately after this renewal, the body of the worm appears gray and somewhat wrinkled, the new coat being made of full size to admit of future growth; but the latter attribute speedily disappears. After the fourth or fifth casting of its skin, it measures from an inch and a half to two inches long; and for a continuous period of about ten days it eats voraciously, and increases greatly, both in length and thickness. On the expiry of this last-mentioned period, it has attained the full size of a silkworm, being from two and a half inches long. Its desire for food abates; it nibbles and wastes its leaves; then ceases to eat, and becomes restless and uneasy, seeking a quiet haven in which to spin its silken shroud. In the course of about twenty-four hours from the time of its having ceased to feed, the silky fluid becomes abundantly supplied to the interior reservoirs; the body becomes of a soft yellow, and somewhat transparent towards the neck. The beautiful silken covering, or cocoon, as it is called, is generally completed in three or four days. It is commenced by the formation of a loose, decomposed structure, of an oval form, made of what is denominated floss silk. Within this, in the course of the ensuing days, the firmer cocoons are constructed. These are rounded somewhat oval balls, varying in tint, some being of a golden tint, some of a straw colour, and others again white. The included worm, having finished its labour, casts its skin once more, but never appears again as a caterpillar, as it now assumes that rounded, shapeless form termed chrysalis. In the chrysalis state it remains a fortnight or three weeks. It then bursts its horny case, coming forth as a moth into the hollow chamber of the cocoon. The moth subsequently emits a fluid, which has the effect either of dissolving the gum or the threads at one end of the cocoon. The length of the thread in a cocoon varies from six hundred to a thousand feet. The perfect insect is remarkable for its dull and stationary habits.

SILURIAN SYSTEM, SILURIAN ROCKS, *si-lu'-re-an.*—A name first applied by Sir Roderick Murchison to a series of fossiliferous strata lying below the Old Red Sandstone, and occupying that part of Wales, and some contiguous counties of England, which once constituted the kingdom of the Silures, a tribe of ancient Britons. It comprises the oldest fossiliferous strata as yet known to geologists. During the last twenty years they have undergone a most minute and careful survey. The system, although consisting in the main of alternate flagstones and sandstones, of argillaceous and calcareous shales, of clayey limestones and limestones of a concretionary character, has been divided into lower and upper groups, which have been subdivided in the typical district into the *Llandeilo*, *Wenlock*, and *Ludlow* series. Abundant traces of invertebrate animal life have been found in the series, and numerous species of zoophytes, echinoderms, mollusca, annelida, and crustacea, have been observed and described. In the upper beds, remains of fishes have also been found; but these only mark the commencement of the Old Red Sandstone period. The Silurian strata are extensively developed in nearly every country in the world. Everywhere it may be divided into two great zones. The upper zone contains limestones and numerous forms of invertebrate animal life,—trilobites, orthocerata, phragmocerata, crinoidea, cystidea, &c. The lower zone is without limestones, and contains few forms of life, especially lingulæ, paradoxides, conocephalas, of species perhaps entering, and of genera mostly distinct from, those of the upper zone. (*See* GEOLOGY.)

SILURIDÆ, *si-lew'-ri-dee.*—The name of a family of malacopterous fishes, exhibiting a great diversity of form, and usually found in the muddy rivers of warm climates. There are many genera comprising various species of which the only European representative is the *Sly Silurus*, also called *Sheat Fish*, or *Shaden* (*Silurus glanis*). This is the largest freshwater fish in Europe, and is found in the Danube, Elbe, and other large rivers. It is six or eight feet long, and often scales 300 or even 400 lbs. Several species are found in the Nile.

SILVER, *sil'-ver* (Sax., *seolfer*, silver: symbol Ag.—*argentum*—equiv. 108, spec. grav. 10·53).—This beautiful metal has been known from the earliest ages, and has always been highly valued for its rarity, beauty, lustre, and permanence. It is of a white colour, with a slight tinge of red. It is between iron and copper in point of hardness, and is very tenacious. It may be hammered into thin leaves and drawn into very fine wire. It fuses at about 1873° Fahr., expanding forcibly at the moment of solidification. It is one of the best known conductors of heat and electricity, and is not oxidized at any temperature, even in the presence of moisture. When perfectly pure, it has the property of absorbing oxygen mechanically at its melting-point, giving it off with effervescence at the moment of solidification; hence the bubbly appearance of the surface of ingots of the pure metal. It has a powerfull affinity for sulphur, speedily turning black in atmospheres containing notable portions of sulphuretted hydrogen. Alloyed with certain proportions of copper, to give it increased hardness and tenacity, it is adopted by all civilized nations for purposes of coinage and for articles of plate. From its purity of colour, it is the most perfect reflector known, and is always employed for reflecting-surfaces when practicable. Silver occurs in nature in the native state, crystallized in cubes and forms derived therefrom. It is generally alloyed with gold, arsenic, and antimony. The most abundant silver ore is the sulphide, which is the principal material occurring in the silver-mines of Mexico, Peru, Norway, Bohemia, and Hungary. It is also found as a sulphide in argentiferous galena and pyrites. Nearly all galena contains sulphide of silver. When the proportion amounts to 3 or 4 ounces per ton, it may be extracted from the metallic lead with profit. (The process is described under the head of LEAD.) In the case of argentiferous copper, it is found with a certain amount of lead. The alloy is heated gradually, so that the lead melts out and flows away, carrying with it the silver, and leaving behind a spongy mass of copper. The argentiferous lead is then submitted to cupellation. The rich ores, such as the sulphides already mentioned, are reduced by the process of amalgamation. The sulphide of silver is converted into chloride by mixing the ore in a finely-divided state with chloride of sodium and roasted copper pyrites. The chloride of copper formed acts on the sulphide of silver, converting it into chloride. Mercury is added to the mass, which decomposes the chloride of silver, and the amalgam so formed is distilled. There are several other methods of separating silver from its ores, for an account of which the reader is referred to Abel and Bloxam's "Handbook of Chemistry." Chemically, pure metallic silver may be obtained by dissolving standard silver in nitric acid; the solution is filtered, and pure chloride of sodium added until the whole of the silver is thrown down. The precipitate is then washed in distilled water until the washings are tasteless. The chloride is then mixed with one-fourth of its weight of oil of vitriol, and bars of zinc are placed in the mass. The zinc gradually reduces the chloride to the metallic condition. It is then washed with sulphuric acid, and lastly with water, until the washings give no precipitate with nitrate of silver. The reduced silver thus obtained is not absolutely pure: it is therefore once more dissolved in pure nitric acid, precipitated by pure hydrochloric acid, and reduced by fusion in a deep clay crucible, with 70·4 per cent. of chalk and 4·2 per cent. of powdered charcoal for an hour and a half.

The only Alloy of Silver worth noting is that used for coinage, the standard for which in this country, as fixed by law, is 11·1 parts of silver and 0·9 of copper.

The Process of Silvering various Articles.—To increase the beauty and usefulness of many articles made of the baser metals, they are often covered with a coating of silver by different processes. *Plating*, properly so called, consists in covering a clean sheet of copper with a thin film of silver by washing over it a solution of lunar caustic. A plate of silver rather larger than the plate of copper is then laid upon it, and the edges turned over. The two are heated to dull redness, and passed through powerful rollers. (The process of electro-plating has already been described under that head.) Of late years, silver has been substituted for mercury in the silvering of glass in numerous instances. The deposition is effected by pouring over the glass a mixture of alcohol, nitrate of silver, carbonate of ammonia, and ammonia to which has been added a few drops of essential oil of cloves. A gentle heat is applied for two or three hours, until the whole of the surface is coated, after which the residue is poured off, and the film of silver is dried and varnished. Grape sugar and Rochelle salt are sometimes added instead of the essential oil. Copper and brass are *silvered* either by rubbing over their cleaned surface a mixture of cream of tartar, chloride of silver, and corrosive sublimate, or by agitating them in mercury in which silver is dissolved. By the application of heat the mercury is expelled, leaving the silver behind as a very thin film.

Silver, Aceto-Nitrate of, in Photography.—The so-called aceto-nitrate of silver, used in photography, is made by adding 1½ drachm of glacial aceto-acid to 50 grains of nitrate of silver dissolved in one ounce of water.

Silver Ammonia-Nitrate of, in Photography.—The so-called ammonio-nitrate of silver, used in photography, is made by adding strong liquor ammoniæ to a solution of nitrate of silver, until the precipitate formed is re-dissolved.

Silver, Bromide of, in Chemistry, Ag.Br.—Bromide of silver may be formed by precipitating a solution of the nitrate with bromide of potassium. It is of a light yellow colour, is insoluble in water, and less soluble in ammonia than the chloride. It dissolves readily in bromide of potassium and other soluble bromides, forming with them double salts, and in hyposulphate of soda. It is one of the constituents of the sensitive film used in the collodion process. It occurs in nature as *bromite*, at Santa Fiora, in Mexico, and in combination with chloride of silver as *enobolite*, in Chili, Mexico, and Honduras.

Silver, Chloride of, in Chemistry.—There appear to be two chlorides of silver—the ordinary chloride, AgCl, and the sub-cloride Ag_2Cl. Chloride of silver is formed as a dense white flocculent precipitate, by adding hydrochloric acid, or a solution of any soluble chloride, to a soluble salt of silver. It is insoluble in water and dilute acids. It is dissolved by boiling hydrochloric acid, and by strong solutions of the alkaline and earthy chlorides, with which it forms double salts. It melts at 500° into a horny mass; hence its old name of *horn-silver*. It is easily reduced by hydrogen, when heated, and by zinc, iron, and most of the easily-oxidizable metals when moist. Cyanide, iodide, and bromide of potassium dissolve it with the formation of double salts. It is also soluble in solutions of the hyposulphates, forming compounds having an intensely sweet taste. In combination with organic matter, it possesses the property of being blackened by light; hence its use in photography. It is found native in most silver-mines, as *kerate* or *horn-silver*. The sub-chloride is obtained by digesting leaves of pure silver in chloride of copper or perchloride of iron. It forms black scales, which are not acted on by nitric acid.

Silver, Iodide of.—Iodide of silver is formed by precipitating the nitrate by iodide of potassium. It is a pale yellow substance, insoluble in acids, and nearly so in ammonia. It dissolves readily in iodide and cyanide of potassium, forming double salts. Its sensitiveness to light renders it of great use in photography. It occurs in nature as *iodide*, in thin flexible plates, in Mexico, Chili, and Spain.

Silver, Nitrate of.—This important salt is made by dissolving silver in strong nitric acid. It crystallizes in square anhydrous colourless tables, and dissolves in an equal weight of water. It fuses when heated, and may be cast in cylindrical moulds, in which form it is used by surgeons as an escharotic, under the popular name of lunar caustic. When perfectly pure, it undergoes no alteration when exposed to light; but if the smallest portions of organic matter be present, it darkens perceptibly. When exposed to light in contact with organic matter, as in the ordinary photographic processes, it forms a dark brownish-purple compound of an organic nature, whose composition is at present but little understood. For photographic purposes, it must be perfectly neutral and pure, free from contaminations of nitric acid and organic matter. For this purpose, the ordinary so-called pure nitrate should be carefully fused and re-crystallized. It is also used as a source of silver in the electrotype process, in silvering glass and in marking-ink.

Silver, Oxides of.—There are three oxides of silver—the sub-oxide, Ag O, is dark powder, formed when nitrate of silver is heated in a current of hydrogen; the protoxide, AgO, procured by adding a solution of potash or soda to the nitrate when it falls, as a brown hydrate; and the peroxide, AgO_2, a compound formed in gray circular crystals when a dilute solution of nitrate of silver is decomposed by the voltaic current. The protoxide is a powerful base, combining with the acids to form neutral salts. It is soluble to a slight extent in water, to which it communicates a feeble alkaline reaction.

Silver Phosphates.—Silver forms several phosphates, but they are unimportant.

Silver, Sulphate of.—When the metal is boiled in sulphuric acid, a portion of the acid is decomposed, and sulphate of silver is formed. It may be obtained in rhombic prisms, which dissolve in ninety parts of water. It is a very stable salt, requiring a greater heat for its decomposition than the sulphates of copper and iron.

Silver, Sulphide of.—This compound is the principal ore of silver, and is found native, crystallized in cubes and octahedra, as well as in massive concretions. It has a metallic lustre, from which it derives its mineralogical name, silver glance. Sulphide of silver is also found in combination with other sulphides, especially those of copper and silver. Metallic silver has a very powerful affinity for sulphur, the metal becoming blackened by exposure to an atmosphere containing sulphuretted hydrogen in the gaseous state, even though largely diluted with air. Sulphide of silver may be prepared chemically by transmitting a current of sylphuretted hydrogen through a solution of the nitrate, or by fusing metallic silver with excess of sulphur in a crucible. In a massive form, sulphide of silver is to a certain extent malleable, and will take impressions from a die.

SIMARUBACEÆ, *sim-a-ru-bai'-se-e* (*simarouba*, its Caribbean name).—In Botany, the Quassia family, a natural order *Dicotyledones*, sub-class *Thalamifloræ*, having the following essential character:—Trees or shrubs, with alternate exstipulate leaves without dots. Flowers hypogynous, regular, symmetrical, with imbricated æstivation. Calyx, corolla, and stamens, with a quaternary or quinary distribution of their parts; each of the latter arising from a hypogynous scale, and with anthers bursting longitudinally. Ovary stalked, 4 or 5-celled; style simple; stigma 4 or 5-lobed. Fruit of 4 or 5 indehiscent 1-seeded drupes, placed round a common axis. Seeds pendulous, exalbuminous; radicle superior. With the exception of one plant, which is a native of Nepaul, they are all found in the tropical parts of India, America, and Africa. A bitter principle is the most remarkable characteristic of the order. (*See* PICRASMA, QUASSIA, SIMARUBA.)

Simaba, *sim-ai'-ba* (its native name).—In Botany, a genus of the natural order *Simarubaceæ*. The seeds of the species *S. Cedron* are highly estimated throughout Central America for their febrifugal properties, and are believed to be a specific against the bites of venomous snakes. They have been used lately in this country for the latter purpose, without any sensible effect.

Simaruba, *sim-a-ru'-ba*.—In Botany, the typical genus of the natural order *Simarubaceæ*. The species *S. amara* is a native of South America and the West-Indian islands, being known in Jamaica as the mountain damson. The bark of the root acts as a tonic, and has been employed medicinally in diarrhœa, dysentery, &c. It contains *quassine*, the same principle which has been found in Jamaica quassia-wood.

SIMIADÆ, *sim'-e-a-de* (Lat., *simia*, an ape).—The name of a quadrumanous family of mammalian animals, which embraces the most highly-developed forms of the monkeys. They are all of them inhabitants of the Old World. The nostrils are divided by a narrow septum; they possess opposite thumbs on their fore and hind feet; the callosities on the rump are generally naked. Some of the species only are furnished with cheek-pouches. They usually possess a tail.

SIMOOM, *si-moom'*.—A noxious hot wind which occurs in most countries situated at no great distance from sandy deserts, and which always blows from that quarter in which the desert is situated. In Senegombia and Guinea, it blows from the north-east, in the delta of the Nile from the south-west, on the eastern shores of the Gulf of Suez from the north-east, in Syria from the south-east; at Mecca from the east, at Bagdad from the west, and at Surat from the north. The approach of the simoom is indicated by terrible appearances. The eastern horizon is pervaded by a dull yellow hue; a thick sulphurous exhalation rises from the ground, which is first hurried round in rapid gyrations, and then ascends into the air, covering the whole heavens. Hissing and crackling sounds are heard, and a hot current of air rushes over the ground. There is generally a considerable quantity of fine sand in the hot air, and the wind generally affects the human body very powerfully, producing great feebleness, and sometimes even death.

SINAPIS, *si-nai'-pis* (Lat.).—In Botany, Mustard, a genus of the natural order *Cruciferæ*. The seeds of two species of this genus are commonly used for culinary and medicinal purposes. The seeds of *S. Nigra* are of a dark reddish-brown colour, and are known as black mustard-seeds; those of *S. alba* are of a yellowish colour, and are termed white mustard-seeds. The flour of mustard, so extensively used as a condiment, is prepared from a mixture of the two kinds, usually in the proportion of two parts black and three parts white. The seeds are pounded, and the husks then removed from the flour by sifting. Both the black and white mustard-seeds contain a large quantity of bland fixed oil, resembling rape, which is readily obtained by submitting them to pressure. It is remarkable that the pungent principle for which mustard is valued does not exist in the seeds, but is produced when the constituents of the seeds are brought together under the influence of water. The acrid and pungent volatile oil of mustard is obtained by distilling black mustard-seeds with water. Internally, flour of mustard is used as a stimulant, diuretic, and emetic; externally, as an irritant and rubefacient. White mustard-seeds are often taken in an entire state as stimulants in dyspepsia. The young herbs with their seed-leaves are commonly used in salads.

SINUS, *sy'-nus*.—In Anatomy, the name given to cells or cavities in certain bones.

In Surgery.—A sinus is much like a fistula.

SIPHON, *si'-fon* (Lat., *sipho*).—A bent tube or pipe, having one limb shorter than the other, by means of which a liquid can be transferred from one vessel to another, without inverting or disturbing the vessel from which the liquid is withdrawn. It is generally supposed that this machine was invented about the 2nd century, by Hero of Alexandria, who, in his works, mentions its employment for the purpose of conveying water from one valley to another over the intervening ground. The method or principle on which the siphon acts, is by exhausting the tube of the air which it contains, or, at least, so rarefying it, that the pressure of the atmosphere on the surface of the water will force the liquid up beyond the highest point of the curve of the siphon, when it will descend by the other limb. The siphon is principally used for decanting; it may, however, be used to discharge water at the upper extremity, by means of an air-vessel at that place. Instead of exhausting the siphon of air, it may be inverted and filled with water; if both ends are then stopped, and the shorter limb immersed in the water to be decanted, on removing the plugs the water will flow. In the *Wirtemberg siphon*, the two ends are turned up, so that when once filled, it will always remain so, and act at once when one end is immersed in a liquid.

SIPHONIA, *si-fo'-ne-a*.—In Botany, a genus of the natural order *Euphorbiaceæ*. *S. elastica*, a native of Brazil and Guiana, is the plant from which nearly all the India-rubber, or caoutchouc, now used in this country is derived.

SIREN, *sy'-ren*.—A genus of perennibranchiate batrachians, declared by Cuvier to be one of the most remarkable of the class of reptiles, and, indeed, of the whole animal kingdom, from the anomalies of its organization and its apparent relationship with different families, and even classes. It has the following characters:—Form elongated, nearly like that of the eel; branchial tufts three on each side; no posterior feet, nor any vestige of a pelvis; head depressed; gape of the mouth not wide; muzzle obtuse; eye very small; the ear concealed; lower jaw armed with a horny sheath and several rows of small teeth; the upper jaw toothless; but numerous small pointed retroverted teeth occur on the palatal region.

SIRIUS, *sir'-e-us*.—In Astronomy, the most brilliant of the fixed stars, and the largest in the constellation of the Great Dog. It is very frequently called the Dog Star. Its name is obtained from Siris, one of the Egyptian appellations of the river Nile, because its heliacal rising gave warning that the overflow of the river was about to commence.

SIROCCO, *se-rok'-ko* (Ital.).—A term applied in Italy to a hot, relaxing, and oppressive south-west wind. It is supposed by some to be identical with the simoom, tempered by its passage across the water.

SKATE. (*See* RAY.)

SKELETON, *skel'-e-ton* (Gr., *skello*, I make dry).—The dry osseous framework of an animal body preserved in its natural position. It usually consists of various parts, and when these are connected together by their natural ligaments, it is said to be a natural skeleton, and when they are artificially connected by wires or the like, it is said to be an artificial skeleton. In some of the lowest class of animals, the skeleton consists only of a single piece, in others it is external, in the form of a case. In man, however, and all the higher animals, the skeleton is internal, and composed of numerous pieces adapted to give strength and beauty to the body, and to admit of motion in various directions. (*See* ANATOMY, OSTEOLOGY.)

SKIN, *skin* (Sax., *scin*).—In Anatomy, is that membrane of variable thickness which covers the whole body externally, and extends inwards into all the natural openings, where it changes its properties, becoming soft and moist, and hence known as mucous membrane. The skin is generally described as composed of three layers,—the cuticle, the *rete mucosum*, and the *cutis vera*, the last being the most internal. The cutis (*dermis*), or true skin, consists of two layers, of which the deeper is called the *corium*, and the more superficial the papillary layer. The corium is composed of numerous fibres closely interlaced, and forming a smooth surface for the support of the papillary layer. It varies in thickness, being, as a general rule, thick on the exposed parts and thin on the protected. The papillary layer is soft, and formed by numerous papillæ, which cover its whole surface. It contains the expansions of the sensitive nerves. The rete mucosum (mucous network) lies immediately over the cutis, and in some measure diminishes the inequalities of its surface, being thicker between the papillæ and thinner on their summits. It is composed of minute nucleated cells, and is almost pulpy in consistence. It is very slightly developed in white races, but is very distinct and thick in those that are darker, the cells, which are filled with a pigment, being that which gives the dark colour to their skin. The cuticle, scarf-skin, or epidermis, is a disorganized scaly substance, serving to protect from injury the more delicate cutis. It is thickest on the most exposed parts; and on the palms of the hands and soles of the feet it consists of several layers. The skin performs various important functions. It is the seat of common sensation, and is furnished with numerous pores or openings, which give passage to the sweat and other exhalations. It is in this way the great regulator of the heat of the body.

Skin Diseases are of very different kinds and of very different degrees of importance. Some are dangerous to life, others are attended with no danger; some are attended with fever and rapid in their course, others are chronic and obstinate; some are disfiguring, some contagious; and so on. Various attempts have been made to arrange and classify the different diseases of the skin. Dr. Hillan divides them into eight orders, distinguished from each other solely by the appearances upon the skin, as follows:—

1. **Papulæ**, or pimples, little elevations of the cuticle, of a red colour, and not containing any fluid, as in the earliest stage of small-pox.

2. **Squamæ**, or scales, small, hard, thickened, opaque, whitish patches of unhealthy cuticle, as in leprosy.

3. **Exanthemata**, or rashes, superficial red patches, varying in figure and size, and irregularly diffused over the surface, as in measles, scarlet fever, &c.

4. **Bullæ**, blebs or miniature blisters, as sometimes occur in erysipelas.

5. **Pustulæ**, or pustules, circumscribed elevations of the cuticle, containing pus, and having red inflamed bases, as in the eruption of small-pox when at its height and maturity.

6. **Vesiculæ**, or vesicles, small elevations of the cuticle, covering a fluid usually at first clear and colourless, but becoming afterwards opaque and whitish, or pearly, as in cow-pox and chicken-pox.

7. **Tubercula**, tubercles, small hard superficial tumours, circumscribed and permanent, or, if they supperate at all, it is only partially.

8. **Maculæ**, spots or patches, arising from excess or deficiency of the colouring matter of the skin, and frequently occurring congenitally, or connected with some slight disorder of the digestive organs or of the general health. Such a classification as this is very useful for the purpose of distinguishing the different appearances, but it is of little further service. They are almost all more or less important manifestations in the cutaneous tissues of disordered or diseased conditions of one or more of the vital functions. Besides, a complaint which is papular to-day may be vesicular to-morrow, and pustular the day following. Some arrangement directing the attention more entirely to the relations and constitutional and vicinal dependencies of these affections, and leading to rational and successful methods of cure, is still wanted.

SKIRRET, *skir'-ret*.—A plant (*Sium Sisarum*), native of China and Japan, belonging to the natural order *Umbelliferæ*. It is now cultivated in Europe for its tuberous roots, which, when boiled, are sweet and nutritious.

SKUA, OR SKUA GULL, *skew'-ah*.—A genus of large sea-birds (*Lestris*) belonging to the family *Laridæ*, found chiefly in the Northern Seas. They usually obtain their food by chasing gulls or other sea-birds, and causing them to give up the fish, &c., they have captured. They also eat eggs and small birds. They differ from the gulls by having the upper mandible more hooked at the top, and larger nostrils which are placed further forward on the bill.

SKULL, *skull* (Sw., *skalle*; Lat., *cranium*).—In Anatomy, is that hard bony case which encloses the brain and forms the head. It consists of eight bones, closely joined together: namely, the frontal bone in front, the occipital bone behind, the two parietal bones on each side, the two temporal bones forming the temples, and the sphenoid and ethmoid bones below, going to the formation of the orbits and nose.

SKUNK, *skunk*.—A carnivorous quadruped (*Mephitis Americana*), belonging to the family *Mustelidæ*, inhabiting America, one species being found in the north and another in the south. The skunk is about as large as a cat. It is low on its legs, with a broad fleshy body, white forehead, and the general aspect rather of a wolverene than of a marten; eyes small, ears short and round. A narrow white mesial line runs from the tip of the nose to the occiput, where it dilates into a broad white mark. It is again narrowed, and continues so till it passes the shoulders, when it forks, the branches running along the sides and becoming much broader as they recede from each other. They approach posteriorly, and unite on the rump, becoming at the same time narrower. The upper lip is furnished with long whiskers; the fur is long and thick, composed of silky and woolly hairs intermixed; the colour is white and blackish-brown, in large masses. The skunk is a nocturnal animal, leaving its burrow at twilight in search of small quadrupeds and the young and eggs of birds. One of its most distinguishing characteristics is its capability of discharging an intolerable stifling stench when threatened with danger—a stench equally intolerable to men, dogs, and cattle. The skunk has one litter a year, of from six to ten young.

SKYE TERRIER, *ski*.—The largest species of "toy" dog, the smallest seldom weighing less than ten or twelve pounds. A thoroughbred "skye" has very short legs and a very long body; its neck is strong, and head elongated, while its body and limbs are covered with long straight hair of a slightly wiry texture, which hangs so thickly over its face as to render the eyes and nose almost invisible. These dogs are very clever at learning tricks, and display considerable affection.

SLATE, *slait* (Fr., *éclater*, to split).—An argillaceous stone which readily splits into plates. The structure of slate is eminently foliated or schistose, splitting, as in the case of roofing-slate, into laminæ as thin as pasteboard. Grey, of various shades, is its prevailing colour; but it is also bluish, reddish, and greenish. It varies considerably as to hardness. It is extensively used for building purposes, for the making of billiard-tables, water-tanks, and for the "slates" of schoolboys. Slate-quarries are worked extensively in North Wales, Westmoreland, Yorkshire, Cornwall, and Devonshire. A valuable variety of slate used for whetstones comes from Sonnenberg, in Meiningen, from Saalfeld, and from the Levant. The slate which is made use of for pencils, in drawing upon the schoolboy's "slate," comes from Spain, Italy, and Bayreuth, in Thuringia. Ehrenberg discovered that the polishing slate found near Zwickau, and near Bilin, which is extensively used as a polisher of metals, are entirely composed of skeletons of infusoria.

SLAVES, OR SLAVONIANS.—A group of nations belonging to the Aryan family, and occupying nearly the whole of Eastern Europe and part of Asia. Thus their territories extend from Kamskatcha to the Elbe, and from the Frozen Sea to the Adriatic. (*See* ETHNOLOGY, ARYAN RACE.)

SLEEP, *sleep* (Ger., *schlaf*).—Is that natural state or condition of unconsciousness in animals which alternates with a period of activity. In this state, the involuntary functions, such as those of nutrition, secretion, &c., go on as usual, but the voluntary powers are quiescent. All action in the living economy produces waste of tissue; and hence rest is necessary in order that the deficiency may be made up. Thus it is that we feel refreshed after sleep; the muscles possess greater strength, the nerves have attained a higher sensibility, and the powers of the mind are more active.

Causes of Sleep.—Many hypotheses have been advanced by physiologists to account for the phenomena of sleep, but all more or less unsatisfactory. According to some, it arises from mere exhaustion of the sensorial powers, the brain ceasing to act because it is fatigued and cannot act further until restored by rest. In many cases, however, we find excessive fatigue, either of mind or body, to be an effectual preventive of sleep. Others, again, refer sleep to changes in the cerebral circulation, regarding it as arising from congestion or a retarded movement of the blood in the cerebral vessels, especially the veins, or, according to some, from a diminished flow of arterial blood to the brain. It is not improbable that several of these causes may be at work in producing sleep—the nervous power being enfeebled by its expenditure during the waking state, and the circulation becoming slower, the vessels become, in consequence, congested, and there is a deficient supply of arterial blood, leading to a suspension of the powers of attention and voluntary motion. According to Sir Henry Holland, sleep is not a single state, but "a succession of states in constant variation; this variation consisting not only in the different degrees in which the same sense or faculty is submitted to it, but also in the different proportions in which these several powers are under its influence at the same time." The approach of sleep is announced by diminished activity of mind, and loss of the power of attention. The senses become blunted to external impressions, and we feel an unconquerable desire for stillness and repose. Our ideas grow more confused, our sensations more obscure, our sight fails us, and if our ears still perceive sounds, they are indistinct and seem as though distant. The eyelids close, the joints relax, and we instinctively assume an easy position and fall into a sleep. As a general rule, the senses and reasoning faculties sleep first, while the imagination and lighter ones remain longest awake. Sleep is at first deep, then soft and gentle, and becomes gradually less sound as the time for waking approaches. There is usually an intermediate state between sleep and waking, in which the sleep is very light, and from which persons can be aroused with the greatest facility. The amount of sleep required by a person varies according to age, temperament, habit, and previous fatigue. The new-born infant sleeps almost continuously, and very old persons also require a great deal of sleep. Middle life is the period when the system requires the least sleep; and women usually require less sleep than men. The average amount of sleep required by a healthy person is about eight hours; but it varies greatly in different individuals, some persons being able to sustain nature with only four hours, while some sluggish persons spend nearly half their time in sleep. Not one of the least strange of the phenomena of this state is the power that some persons have of awaking at a particular hour predetermined on.

SLOE. (*See* PRUNUS.)

SLOTH, *slaath* (Sax., *slæwth*).—An herbivorous edentate animal (*Bradypus tridactylus*) of South America, remarkable for the extreme slowness of its motions and the awkward appearance of its proportions. The arm and fore-arm taken together are nearly twice as long as the leg and thigh; so that if the animal attempts to walk on all fours, it is obliged to trail itself painfully and slowly on its elbows, and if it stands upright on the hind-legs, the arms are so long that the fore-fingers touch the ground. It is, accordingly, exceedingly helpless when upon the ground, and at home only when on trees, and resting or moving suspended beneath their branches. For this their structure is admirably fitted. It feeds on leaves. The head of the sloth is soft, the face small and round, its hair coarse and shaggy, and generally resembling in colour dry withered grass or moss. The best known species, the *Three-fingered* or *Three-toed Sloth*, is also called the *Ai*; it is brownish gray in colour, and has a more obtuse muzzle than some other species.

SLUG, *slug*.—A genus (*Limax*) of air-breathing naked gastropodous molluscs. They have an elongated body, and for a mantle a fleshy compact disc, which occupies the anterior part of the body alone, and covers the pulmonary cavity only. This disc contains, in many species, a small oblong and flat shell, or, at least, a calcareous secretion in lieu of it. They feed on herbs and fruits, to which they do much damage. They deposit their ova at any time of spring or summer, when the weather is moist, and bury themselves in the earth during drought and frost.

SMALL-POX, *smawl-poks* (Lat., *variola*).—An eruptive febrile disease, which, happily, is not now nearly so prevalent as it once was. It seems very doubtful whether this disease was at all known to the ancients; and, according to some Arabic historians, it came first from Ethiopia into Arabia about A.D. 572. The wars which were carried on in the East, and particularly the Crusades in the 12th and 13th centuries, introduced it into Europe, first into Spain and France, and then into other countries. This disease commonly commences with the usual febrile symptoms; as rigours, pain in the back and loins, great prostration of strength, followed by heat and dryness of the skin, a hard and frequent pulse, loss of appetite, pain in the epigastrum, with nausea, vomiting, headache, and sometimes delirium or convulsions. About the third day, an eruption of small hard red-coloured pimples makes its appearance about the face and neck, and gradually extends over the trunk and extremities. The pimples gradually ripen into pustules, which, on the eighth day, generally begin to break, and crusts or scabs form, these last falling off in four or five days more. The severity of the disease varies much in different instances, but is almost always in direct relation to the quantity of the eruption. When the pustules are numerous, they run together, and form an irregular outline; when fewer, they are distinct, and of a regularly circumscribed circular form. The former is technically called *variola confluens*, the other *variola discreta*; the former being never free from danger, the latter seldom or ever dangerous. The most important difference between the two forms is in the secondary fever, which sets in about the eighth day of the eruption, or just when the maturation of the pustules is complete. It is slightly marked in the distinct small-pox, but generally very intense and perilous in most instances of the confluent; being the period at which death oftenest occurs. Both kinds are accompanied by sore throat, salivation, and frequently diarrhœa. A peculiar disagreeable odour also usually proceeds from the body of the patient. Like measles and scarlatina. this disease frequently gives rise to others of a troublesome or dangerous nature; as glandular swellings, abcesses, pleurisy, loss of sight, consumption, &c. Small-pox is the effect of specific contagion, communicated by contact, or through the air. There is no disease of which the contagion is so sure, and which operates at a greater distance, than that of small-pox; but it rarely attacks the same individual more than once. It is not a little remarkable that a small quantity of the matter taken from a pustule, and inserted beneath the skin of a healthy individual, gives rise to a much milder form of the disease than would arise in the natural way, *i.e.*, by inhaling the contagious poison; and to this fact are we indebted for the great means of guarding against the disease. (*See* INOCULATION, VACCINATION.) The treatment required in small-pox does not differ particularly from that of ordinary fever; the bowels requiring to be kept moderately open, free ventilation established, and the skin, if necessary, kept cool by sponging it with tepid vinegar and water. Small doses of mercury are often serviceable in moderating the febrile symptoms. The strength requires to be attended to, and if much reduced, quinine, wine, and nourishing diet are to be employed. Blood-letting is almost always attended with very great danger, and should not be attempted if it can possibly be avoided. The complications of this disease require to be carefully watched; and if the throat be much affected, a blister should be applied to the neck, and gargles of infusion of roses used.

Small-pox in Sheep.—This disease (*Variola ovina*) much resembles small-pox in human beings, but is in fact a distinct disease, and is not communicable to dogs or goats. It was not known in this country until 1847, where it appears to have been imported from abroad by variolous sheep, or infected skins. The disease is marked by fever, a discharge from the nose, and a hot tender skin; red pimples appear, which in about three days become white scabs or ulcers. Good food and nursing must be supplied, and if necessary the whole flock should be inoculated, for the disease thus produced is much milder and prevents all risk of contagion.

SMALT, *smawlt*.—Coloured glass compositions used for making tesseræ. (*See* COBALT.)

SMELL, SENSE OF, *smell*.—In living animals, is the power or faculty of perceiving odours. For that purpose, the animal is provided with a special nerve, called the olfactory nerve, in which alone this faculty resides. In man, the filaments of this nerve are distributed in minute arrangements in the mucous membrane covering the anterior and upper cavities of the nose. (*See* NOSE.) The branches are distributed principally in close plexuses, but the mode of termination of the filaments is not yet satisfactorily determined. Besides the sense of smell, the nasal cavities are endowed with common sensibility, by the nasal branches of the first and second divisions of the fifth nerve, as is proved by those cases in which the sense of smell is lost, while the party still remains susceptible of sensations of cold, heat, itching, tickling, &c. The olfactory nerve is susceptible of an infinite variety of states, dependent on the nature of the external stimulus by which it is brought into a state of activity. All animals do not perceive the same odours in an equal degree. Carnivorous animals, for instance, have the power of detecting by the smell the special peculiarities of animal matters, and of tracking other animals by the scent, but apparently no sensibility to the odours of plants and flowers; while, on the other hand, herbivorous animals are peculiarly sensitive to the latter, and have little sensibility to animal odours. Man is inferior to many animals in respect of the acuteness of smell, but his sphere of susceptibility to various odours is more uniform and extended. Odours, in the case of animals living in the air, arise from substances suspended in a state of extremely fine division in the atmosphere, or gaseous exhalations, often of so subtle a nature that they can be discovered by no other agent than the sense of smell itself. The odorous matters also require to be transmitted in a current through the nostrils, which is effected by the respiratory organs; and hence our perception of them is increased by repeated quick inspirations, as in sniffing. They are in all cases dissolved in the mucous of the mucous membrane before they affect the olfactory nerve; and hence this membrane must not be either too moist or too dry. The cause of the difference in the effect of different odours is unknown. Great differences in this respect exist among different individuals, many odours which are generally thought agreeable being to some persons intolerable; and different persons describe differently the sensations which arise from the same odorous substances.

Furthur, the acuteness of this sense differs greatly in different individuals, and there seems to be in some persons insensibility to certain odours, and in the case of sight, to certain colours. Linnæus has divided odours into seven different classes:—(1) aromatic, as the carnation; (2) fragrant, as the lily; (3) ambrosiac, as musk; (4) alliaceous, as garlic; (5) fœtid, as the rag-wort, valerian; (6) virulent, as Indian pink; (7) nauseous, as the gourd. Professor Bain attempts a more philosophical classification, viz.—(1) Fresh odours, or such as have the effect of stimulating and reviving the system, as eau-de-Cologne; (2) close or suffocating odours, which have a damping and discouraging effect upon the powers of life, as the smell of a pastrycook's kitchen; (3) disgusting or nauseous odours, that pervert the action of the alimentary canal, as sulphuretted hydrogen gas; (4) sweet or fragrant odours, which convey to the mind a perfectly pleasureable sensation, as many of the flowering and fruit-bearing plants; (5) bad odours, or such as are repulsive by their action on the olfactory nerves alone, as asafœtida; (6) pungent odours, as that of ammonia; (7) ethereal odours, as of alcohol and the ethers; (8) appetizing smells, or such as excite the appetite, as that of flesh among carnivorous animals.

SMELT, *smelt* (Sax.).—A small but delicious fish (*Osmerus*) allied to the salmon. It inhabits fresh water from August to May. After spawning in March or beginning of April, it returns to the sea. The length generally six or seven inches. The generic characters are: body elongated, covered with small scales; two dorsal fins, the first with rays, the second fleshy without rays; ventral fins in a vertical line under the commencement of the first dorsal fin; teeth on the jaws and tongue very long, two distinct rows on each palatine bone, none on the vomer except at the most anterior part; branchiostegous rays 8. The smelt, as a British fish, appears to be almost exclusively confined to the eastern and western coasts of Great Britain. The food of smelts is small fish, with crustaceous animals.

SMEW, *smew*.—A bird (*Mergellus albellus*) closely allied to the goosander and merganser, but having a shorter bill. It belongs to the family *Anatidæ*. (*See* MERGANSER.)

SMILACEÆ, *smi-lai'-se-e*.—In Botany, the Sarsaparilla family, a natural order of *Monocotyledones*, sub-class *Dictyogenæ*. Herbs or shrubs, more or less climbing. Leaves petiolate, net-veined, articulated. Flowers regular, unisexual, and diœcious or hermaphrodite. Perianth inferior; 6-parted, with all its divisions alike. Stamens 6, perigynous or rarely hypogynous; anthers introrse. Ovary superior, 3-celled; stigmas 3. Fruit a berry, few or many-seeded. Seeds with a minute embryo, albuminous. The species are distributed over various parts of the world, both in tropical and temperate climates, being most abundant in tropical America. (*See* SMILAX.)

SMILAX, *smi'-laks* (Gr.).—In Botany, Sarsaparilla, the typical genus of the natural order *Smilaceæ*. The roots of several species or varieties constitute the sarsaparilla of the Materia Medica, and are so largely used in this country, that upwards of 130,000 lbs. require to be annually imported. Sarsaparilla is regarded as an alterative in venereal and skin diseases, rheumatism, &c. The kind most valued is that known as Jamaica sarsaparilla, obtained from the species *S. officinalis*. It is not the produce of Jamaica, but of Central America and the northern parts of South America. Other kinds distinguished in commerce are "Lima," "lean Vera Cruz," "gouty Vera Cruz," "Lisbon," or "Brazilian," and "Honduras." Among the European species is *S. aspera*, the roots of which form Italian sarsaparilla.

SMOKE, SMOKE NUISANCE, *smoke* (Sax., *smoca*).—The exhalations, visible vapour, or substance, that escapes, or is expelled, in the process of combustion, from the substance burning. (Under the articles COMBUSTION, FLAME, and FUEL, the principle of combustion is fully explained.) Those fuels which consist chiefly of fixed carbon, as anthracite and the coke of bituminous coal, evolve no smoke, for the first movement of the carbon into the air is when it combines with the oxygen to form the invisible carbonic oxide, from which it is not again set free. In nearly every process of combustion, whether the object be the attainment of light or heat, the formation of smoke should be guarded against as a waste of fuel. In large cities, where bituminous coal is consumed as the common fuel, the atmosphere is constantly charged with clouds of smoke, which is diffused over everything. In England this was deemed a nuisance so far back as the time of Queen Elizabeth, when the smiths, brewers, and others were just commencing to use "pit coal." Since that period the nuisance has increased in magnitude, and many attempts have been made to mitigate the evil by compelling manufacturers to adopt improved methods of combustion, or the use of smokeless fuel. In this way coke has come to be universally used upon the railways of Great Britain. Several plans, at once efficient and economical, have been supplied to manufacturers. The object of these plans has been either to prevent the production of smoke by effecting complete combustion in the furnace, or to consume the smoke after it has been evolved from one fire by causing it to pass over another supported by smokeless fuel. It has been ascertained that the great mass of smoke is sent forth from fuel freshly thrown on a fire, and that when the fire becomes hotter the smoke diminishes; this is owing to the sweeping off of the carbon before it could be fairly exposed to the further action of the heat and air. This leads to the method which adds the fuel gradually and spreads it over the front portion of the grate, so that the smoke shall have to pass over the fire behind, and thus be consumed as it mixes with the excess of air carried along with it; hence this method of preventing smoke, by consuming it in the furnace, has been adopted very generally.

SMOLT, *smowlt*.—The name sometimes given to a young salmon from 4 to 8 or 9 inches in length. (*See* SALMON.)

SMUT, *smut*.—The common name for small fungi which affect corn, grasses, and other plants, and throw off a number of dark-coloured spores. The fungi belong to the section *Coniomycetes*, family *Uredineæ*.

SNAILS, *snailz* (Sax., *snægel*, a snail).—A family of gasteropodous molluscs (*Helicidæ*) living on the land, and breathing air by means of lungs, and possessed of a well-developed external shell. They respire free air in a closed chamber lined with pulmonic vessels, usually placed on the front of the back of the animal, and covered by the shell, and having an opening closed by a valve on the side. They are hermaphrodite, with reciprocal impregnation. The teeth are numerous, and placed in many cross series on the lingual membrane; the head is furnished with four retractile tentacula, the two upper possessing eyes at the apex. The whole body is very glutinous.

SNAKE-BIRD. (*See* DARTER.)

SNAKE-NUT. (*See* OPHIOCARYON.)

SNAKES, *snaikes* (Sax., *snaca*, a snake).—A genus (*Anguis*) of Ophidian reptiles differing much in their structure and most of their characters from the true serpents. The animals which are included in this genus are among the most harmless on the face of the earth. There are several species, or rather genera, varying from the common blind-worm of Britain (*Anguis fragilis*) to the acoritias of warmer climates; but they are all equally harmless. The external characters are, the scales on the back and belly alike in size, whereas the true serpents have those on the belly larger and free at their posterior edge. The upper jawbones are articulated immediately to the skull and the intermaxillary bones, so that on opening the mouth the animals cannot raise the upper jaw; and as they can depress the lower jaw only a little way, their gape is very narrow. Their motion is not that of the serpent, but consists of a series of alternate archings and straightenings.

Snake-Weed. (*See* POLYGONACEÆ.)

Snake-Wood.—A beautiful fancy wood obtained from *Piratinera guianensis*, a plant belonging to the Bread-fruit order. Owing to the peculiar markings upon it, it is sometimes called letter-wood.

SNAPDRAGON, *snap'-drag-on.*—A genus of plants belonging to the natural order *Scrophulariaceæ.*

SNEEZING, *sneez'-ing* (Goth., *snesa*).—A convulsive motion of the muscles of respiration. It is preceded by a deep inspiration that fills the lungs; the air-passages are then closed at the fauces, a sudden and violent contraction of the muscles of expiration takes place, and the passages by the mouth and the nasal canal are suddenly opened simultaneously, or the nasal canal alone. It is always occasioned by some irritation affecting the inner membrane of the nose, or, at least, it is always felt there, though it may exist in some other part, and may be produced by very different causes. The irritation must possess a certain degree of acuteness; for every one must have felt that when this is not the case, the disposition to sneeze suddenly passes off, though the act had been desired, and had seemed on the point of being accomplished. In several respects it resembles coughing. Various superstitious notions and customs have been associated with the act of sneezing. The custom of blessing people when they sneeze is mentioned by various ancient authors, and is so ancient that Aristotle professes ignorance of the origin of it. Among the Greeks, it was generally regarded as a good omen. Sneezing has been known to cause death; and it is reported that in the time of Gregory the Great an epidemic distemper prevailed in Italy, which carried off by sneezing all who were seized by it. It is, however, very rarely dangerous, and is frequently regarded as a favourable symptom.

SNEEZE-WOOD.—In Botany, the common name of *Pteroxylon utile*, belonging to the natural order *Sapindaceæ.* The sawdust of this tree possesses sternutatory properties, which, acting on the noses of workmen, has gained for it its ordinary name. The tree is a native of South Africa, and its wood is remarkable for its durability, strength, and beauty. The Dutch name of this tree is Nieshout.

SNIPE, *snipe* (Du., *snip*).—The snipes belong to the family of the *Scolopacidæ.* There are several species; those most familiar to the English sportsman and ornithologist being the common snipe, the jack snipe, and the solitary snipe.

The Common Snipe (*Scolopax Gallinago*) is indigenous to this country, breeding in small numbers in most, if not in all, the counties along the southern line of the English coast, but producing its eggs and young much more frequently in the northern counties of England, in Ireland, in Scotland and its islands, than in the south. In addition to our native snipes, great flights come annually from Norway and other parts of Northern Europe; seldom remaining long in one situation, but moving from place to place. Towards the end of March or the beginning of April, snipes have nearly perfected their nuptial plumage, and select appropriate places for nidification. The nest is very slight, consisting only of a few bits of dead grass or dry herbage, collected in a depression on the ground, and sometimes upon or under the side of a tuft of grass or bunch of rushes; the eggs four in number, of a pale yellowish or greenish-white, the larger end spotted with two or three shades of brown; the length of the egg about one inch six lines, by one inch one line in breadth. Marshes, moist meadows, and, in frosty weather, the edges of rushy rills, are the haunts of the snipe. In such situations they have been seen pushing their bills quite up to the base, in search of their food, which consists of worms, insects, and small molluscs. The whole length of the common snipe is about ten inches and a half; the length of the beak about two inches and three-quarters. In winter, the beak is dark-brown at the end, pale reddish-brown at the base; all the upper part of the head very dark brown; divided along the centre by a single pale brown streak; the back dark brown, slightly spotted with pale brown; the throat white; the cheeks, neck, and upper breast mottled with black and light ferruginous patches; lower breast and belly white; the quills black, the upper ones being tinged with white, and those next the body seriated and barred with light ferruginous strips; the tail consists of fourteen black feathers, barred and spotted with dull orange-red towards the end. The colours of the plumage after the spring moult are brighter and more brilliant than after the autumnal moult.

The Jack Snipe (*Scolopax Gallinula*) is a winter visitor only to this country. It is smaller than the common snipe, and is rather a rare bird; is usually found alone, and will frequently almost allow itself to be trodden on before it will rise. When it does, it wings its way so heavily as to discompose the sportsman as much by its sluggish flight as the larger variety often do by their rapid unsteady dartings. It feeds on bare boggy ground; but when not searching for food, it chooses sheltered situations among strong rushes, or coarse long grass.

The Solitary Snipe (*Scolopax major*) is a very rare bird in England, and is sometimes called the great snipe, being from fourteen to sixteen inches in length. The head-quarters of this bird is the north of Europe. It requires solitude and perfect quiet, and is seldom found except where there is a great extent of marshy meadow. There are two other snipes which exceed this in size, found in the hilly districts of India; and a third from Mexico, whose size is superior to that of a woodcock.

SNOW, *sno* (Sax., *snaw*).—When the temperature of the atmosphere falls below the freezing-point of water, the particles of moisture are precipitated in the form of flaky-crystals of ice, called snow. These crystals are united together in such a manner as to reflect light to the eye in great abundance from all, thus producing a sensation of whiteness. Under the microscope, these crystallized particles present every variety of shape. Dr. Netlis, of Middlesburgh, was the first to describe them in 1740. Dr. Scoresby also, in his account of the Arctic regions, states that he collected as many as ninety-six varieties of snow: these he arranged in five separate classes, of which the three leading forms were the lamellar, the pyramidal, and the spicular. The presence of air in snow renders it opaque, otherwise it would be transparent like ice and other crystallized bodies. Regular crystals of snow are only found where the air is still and the temperature very cold; they do not, therefore, often occur in temperate regions. In the polar regions, snow has been seen of red, orange, and salmon colour. This phenomenon occurs both in the fixed and floating ice, and seems to result in some cases from vegetable and in others from animal matter suspended in the water and deposited upon the surrounding ice. In some cases, snow-storms have been known to present a luminous appearance, covering every object with a sheet of fire. In general, the electricity of snow is positive, and by chemical analysis it has been found that snow-water contains a greater proportion of oxygen than rain or river-water—a fact which accounts for its superior activity in causing iron to rust, &c. In the economy of nature, snow answers many valuable purposes. By its gradual melting in high regions, it serves to supply streams of running water, which a sudden increase in the form of rain would convert into destructive torrents or standing pools. In many countries snow tempers the burning heat of summer, by cooling the winds which pass over it. On the other hand, in colder climates snow serves as a defence against the severity of winter, where it protects plants against the frost, and serves as a shelter to animals, which bury themselves in it. An open, snowless winter is destructive to vegetation even in more temperate regions, and Alpine plants have perished in the mild winter of England for want of their usual protective covering of snow.

Snow-Line.—The elevation at which mountains are covered with perpetual snow is called the snow-line, or plane of perpetual snow. The snow-line on the northern side of the Himalayan mountains is about 17,000 feet; on Chimborazo, 15,802 feet. The altitude of perpetual snow under the equator was fixed by Humboldt at 15,748 feet; towards the poles it is considerably lower. The snow-line of the Alps under 46° north latitude is only 8,860 feet, and that of the Pyrenees about 8,850 feet. At the North Cape, in latitude 71°, it is only 2,240 feet. The position of the snow-line in all mountains, however, depends so much on variable causes, such as the form of the summits, the comparative altitude, and other physical features of the surrounding country, the particular exposure of the mountain, &c., that no general rule can be laid down for determining the altitude of perpetual snow.

SNOW-BALL TREE. (*See* VIBURNUM.)

SNOW-BERRY.—A bushy shrub, with simple leaves and small flowers, bearing white berries about the size of black currants. It belongs to the natural order *Caprifoliaceæ*.

SNOW-BUNTING.—A bird which, according to Linnæus, is the only living thing that has been seen 2000 feet above the level of perpetual snow on the Lapland mountains. Though belonging to the bunting family, the snow-buntings have the claw of the hind-toe long and nearly straight like the larks.

SNOWDROP.—A genus of beautiful little flowers (*Galanthus*) belonging to the natural order *Amaryllis*. The root is bulbous; the flowers arise from a spathe; the three outer segments of the perianth spread so as to make a bell-shaped flower. The botanic name of the common snowdrop is *Galanthus Nivalis*.

SNUFF. (*See* TOBACCO.)

SOAP-TEST, CLARK'S.—In Chemistry, a ready method of testing the hardness of water, devised by the late Dr. Clark of Aberdeen. It is founded on the fact of the hardening constituents of water possessing the property of destroying the lathering powers of a solution of soap. Potash in soda soap is therefore disolved in water until a certain strength is obtained. This is determined by means of a solution of sulphate of lime, in water of known hardness, the soap solution being weakened or strengthened until a certain measure, say an ounce, indicates 1 grain of carbonate of lime, or 1° of hardness. A pint of the water to be examined is then taken, and the standard soap solution is added until the mixture lathers on agitation, the amount used indicating the degree of hardness. Thus, supposing 2½ ounces to have been required, it would indicate 2½ grains of hardening salt per pint, or 20 grains per gallon, *i.e.*, 20° of hardness of Clark's scale.

Soap Berry. (*See* SAPINDUS.)
Soap Wort. (*See* SAPINDACEÆ.)

SOBRALIA, *so-brai'-le-a.*—In Botany, a genus of the natural order *Orchidaceæ*. One species is said to yield in Panama a kind of vanilla, which is called *chica*.

SOCIAL SCIENCE.—Of recent years this name has been given to the study of everything relating to the social improvement of the people and the community at large.

Social Science, Natural Association for the Promotion of.—This Society was organized at a meeting held at Lord Brougham's residence, in July, 1857. Its object being to consider the best means of union among those who were interested in social improvement and who wished to join. Every year it holds a great Meeting or Congress in one of the great cities of the kingdom.

SODA, *so'-da.*—In Chemistry, NaO, the protoxide of the alkaline metal sodium. It may be procured in an anhydrous state by burning the metal in dry air or oxygen. It is of a white colour, greedily abstracting water from the air, which cannot be expelled by heat. In this state it forms hydrate of soda, or caustic soda, and is so similar in its properties to hydrate of potash, that it need not be fully described here. (For its commercial manufacture, *see* sub-heading SODA MANUFACTURE.)

Soda, Carbonates of.—There are three of these,—the ordinary mono-carbonate, or common washing soda, $NaO.CO_2$, which, in its crystalline form, contains ten equivalents of water; the sesquicarbonate, $2NaO.3CO_2+4aq$, which occurs in the mineral kingdom as *trona* and *urao*; and the bicarbonate, $NaO.CO_2\ HO.CO_2$, which is prepared by passing carbonate acid through a concentrated solution of the carbonate until saturation takes place. It is also prepared by exposing the crystallized mono-carbonate to the action of a current of carbonic acid; but in this method of making it, only the outside portions of the converted crystals should be used, the inner parts being only partially changed. It is ground and dried at a very gentle heat, care being taken to avoid a high temperature, which would cause the formation of the sesquicarbonate. Bicarbonate of soda crystallizes in prisms. It occurs in commerce as a white crystalline powder, which is gradually converted into the sesquicarbonate by exposure to the air. It is much used in medicine, having a much less unpleasant taste than either the mono or sesquicarbonate, from which it is readily distinguished by giving no precipitate with the magnesia salts. (The properties of the mono-carbonate are described under SODA MANUFACTURE.)

Soda, Hyposulphite of.—This important salt is now manufactured in tons for photographic purposes, and as an antichlore to extract the last traces of chlorine from paper pulp. It is prepared by fusing equal weights of carbonate of soda and flour of sulphur, and transmitting sulphurous acid through the solution of impure sulphide of sodium thus formed. The liquid is evaporated, and hyposulphite of soda crystallizes from the solution in bold prisms.

Soda Manufacture.—The prepartion of carbonate of soda, or soda as it is commonly called, is the most important chemical manufacture of Great Britain. The unlimited stores of coal, chalk, salt, and sulphur existing in this country have been the means of placing us at the head of the soda trade, some notion of the vastness of which may be gained by the fact that the annual manufacture of this article has reached nearly 2,500,000 tons, made in fifty different manufactories by over 10,000 workmen. Previous to the establishment of the French republic in 1793, soda was obtained almost entirely from the ashes of certain plants growing on the seaboards of Spain, Sicily, Scotland, and Ireland. The French revolution having cut off all the supplies of alkali from France, a commission of chemists was appointed by the republic to consider the best means of supplying the want from French sources. About four years before, a simple chemist and druggist, named Leblanc, had established a manufactory for making soda from common salt; but, owing to revolutionary troubles, his experiments had been discontinued. Through the exertions of the commission, however, the manufactory was re-established at the national expense. Leblanc's process, strange to say, has never been improved, its simplicity being so great as to resist the endeavours of the most eminent chemists, both practical and theoretical, to alter even its details. For at least twenty years, the heavy duty of £30 per ton on common salt prevented the use of the process in this country; the impost, however, was removed in 1823, and the soda manufacture has progressed since that date until it has assumed its present gigantic proportions. The preparation of carbonate of soda from common salt may be divided into three principal operations:—1. the production of salt-cake or crude sulphate of soda; 2. the transformation of the sulphate of soda into black ash, or impure carbonate mixed with sulphide of sodium, by roasting with chalk and coal; 3. the extraction of soda-ash, or dry carbonate, by lixiviation with water and evaporation to dryness. The first process is performed by placing about 6 cwt. of ordinary salt in a strong iron pan, and mixing it with an equal weight of oil of vitriol. The mixture is then removed to a reverberatory furnace, and the flame allowed to play on its surface until the whole of the hydrochloric acid is driven off, and the chloride of sodium transformed into a dry mass of sulphate of soda or salt-cake, as it is termed. The salt used is obtained from the salt-springs of Cheshire, and the sulphuric acid is made from iron pyrites from Lancashire, Wicklow, Spain, or Portugal. The hydrochloric acid produced is condensed, and used either for the production of chlorine in the manufacture of bleaching-powder, or for extracting the copper from the iron pyrites used in making the sulphuric acid. The second process, the making of the black-ash or impure carbonate of soda is effected by mingling the sulphate of soda, or salt-cake, formed in the first process, with chalk and powdered coal in the proportions of three parts of sulphate of soda, three of chalk, and two of coal. The mixture is thrown into a reverberatory furnace in quantities of 2½ cwt. at a time, and frequently stirred until melted. Towards the conclusion of the operation, a violent effervescence takes place, carbonic oxide escaping in large quantities, and burning with a green or yellow flame; the products being carbonic oxide, which burns; sulphide of lime, which remains behind; and carbonate of soda, with which it is mixed. This intermediate action is the foundation of the whole process. In practice, an excess of coal and chalk is employed, as much of the coal burns away, and an excess of lime is required in order to prevent the formation of any of the soluble sulphides of calcium. The amount of carbonate of soda contained in black ash is about 20 per cent. It is extracted from the mass by breaking it into small fragments, and digesting it with warm water for several hours in large vats, provided with false bottoms, the last and weakest washings being used to act on fresh portions of black ash. When the lixivium is sufficiently concentrated, it is transferred to evaporating pans. The residue left behind is known as soda waste, and consists of a mixture of oxysulphide of calcium and unburnt coal. The efforts of numerous chemists have been fruitlessly employed for the last fifty years in endeavouring to utilize this waste product which collects gradually near all soda-works, and ultimately forms large mountains. The solution of crude carbonate of soda is generally of a dark green colour, from the accidental admixture of iron or manganese, and contains certain proportions of hydrate and sulphate of soda, which are converted into carbonate by mixing the evaporated salts with small coal and sawdust, and in heating in a reverberatory furnace. The resulting salt, which is the soda-ash of commerce, is then once more dissolved in water, the solution evaporated to crystallization, when large rhomboidal crystals of ordinary washing-soda are obtained. These consist of carbonate of soda with ten equivalents of water. Hydrate of soda is made by boiling soda-ash solution with milk of lime, the operation being conducted by Messrs. Roberts, Dale, and Co., of Manchester, in their ordinary steam-engine boilers; by which means they not only causterize their soda for nothing, but keep their boilers perfectly clean and supply their engines with steam at an increased pressure. Hydrate of soda, or caustic soda as it is termed commercially, is used largely by soapmakers in the manufacture of hard soaps. The crude carbonate is employed in glass-making and soda-crystals, or common washing-soda, for detergent purposes. Various experiments have been tried to improve Leblanc's process without effect, the only alteration of it since his day being the manufacture of the sulphuric acid from pyrites instead of sulphur. Some years since, Mr. Longmaid patented a process for obtaining the sulphate of soda by fusing common salt and iron pyrites together in a reverberatory furnace; but it has not come into general use. A mixture of the carbonates of soda and potash fuses at a lower temperature than either of its constituents. It is therefore much employed as a means of decomposing silicious minerals in the laboratory.

Soda, Nitrate of.—In Chemistry, this salt occurs (like nitrate of potash) as an incrustation on the earth in certain hot districts, more especially in Chili and Peru, where it is found in layers of considerable thickness. It crystallizes in large rhomboidal masses—whence its commercial name of cubic nitre. Exposed to the air it deliquesces, and therefore cannot be substituted for nitre in the manufacture of gunpowder. It is largely used in the manufacture of nitric acid, being cheaper than nitrate of potash, and yielding a larger percentage of acid. It was exported in large quantities during the Russian war (the trade in sulphate being interdicted, that article being contraband of war), for the manufacture of nitre by double decomposition with carbonate or sulphate of potash.

Soda, Phosphates of.—With phosphoric acid, soda forms a large number of crystallizable salts, the most important of which is the rhombic phosphate. It forms large transparent efflorescent rhombic prisms, which have a cooling saline taste, and are very soluble in water. It is used medicinally as a purgative, and is employed in analysis.

Soda, Sulphate of.—Purified sulphate of soda, popularly known as Glauber's salt, is used medicinally as a purgative. In its crude state it is manufactured in enormous quantities from common salt and sulphuric acid, forming *salt-cake*, one of the steps in the soda manufacture (which *see*). In its anhydrous condition, it sometimes forms an incrustation on the surface of the soil, in which state it is known to mineralogists as Thenardite. It is also a large product in the manufacture of nitric acid from nitrate of soda.

Soda, Sulphite of.—This salt is made on a large scale by passing sulphuric acid over moist soda crystals. By careful evaporation, it may be obtained in transparent five or six-sided prisms, which, when exposed to the air, become covered with an opaque crust of sulphate of soda. It has been lately much employed as an antichlore for the preservation of wines and in refining beetroot sugar.

SODIUM, *so-de'-um*.—In Chemistry, symbol Na (natrium); equivalent 22·97; specific gravity 0·972: fusing-point 194° Fahr.,—the alkaline metal of which soda is the oxide. It was discovered in 1807 by Sir Humphrey Davy. It occurs in large quantities in nature, chiefly in combination with chlorine, as sea-salt. It is also found united with oxygen in certain common minerals, such as albite, analcime, labradorite, and kryolite. It also occurs in the form of nitrate, carbonate, biborate, and sulphate. It is found in the ashes of plants, especially those which grow near the sea, such as the *Salsola Soda*, formerly the great source of sodium and its compounds, now principally obtained from sea and rock-salt. Sodium has lately become an article of commerce, in consequence of the demand which has arisen for it for the manufacture of aluminium. M. Deville recommends the following method of obtaining this valuable metal:—Dried carbonate of soda 717 parts, powdered charcoal 175 parts, and finely-powdered chalk 108 parts, are mixed intimately, and kneaded into a stiff paste with oil, and calcined in a covered iron pot. The mass is then introduced into a retort, and distilled with the same precautions as those used in the manufacture of potassium (which *see*). This mixture generally yields one-third its weight of sodium, and by this means sodium is now manufactured at about 10s. per pound. Sodium is a yellowish-white lustrous metal, resembling silver more closely than potassium. It is soft, and may be readily cut with a knife, or moulded with the fingers. Exposed to the air, it tarnishes immediately, becoming covered with a film of soda: it is therefore preserved in petroleum or some other hydrocarbon. Heated in the air or oxygen, it burns with a bright yellow flame, and is converted into soda. Thrown upon water, it decomposes rapidly, but without eliminating sufficient heat to kindle the hydrogen formed. It is much used in chemical operations for the reduction of the elements having a great affinity for oxygen, such as boron, silicon, calcium, barium, magnesium, &c.; and in the arts for the reduction of aluminium. Its amalgam with mercury, from not requiring to be kept under naphtha, is frequently used for this and other purposes, when a strong deoxidizing agent is required. Mercury is placed in a strong glass flask, and heated to about 300°; the sodium is then dropped in pieces the size of a pea. When the whole of the sodium is added, the amalgam is poured out in a flat dish until cold, when it is broken up in small pieces, and kept in a stoppered bottle.

Sodium, Bromide and Iodide of.—These two salts occur sparingly in sea-water and in the ashes of sea-plants, and are the principal commercial sources of iodine and bromine. Like the corresponding salts of potassium, they crystallize in anhydrous cubes, which deliquesce on exposure to the air.

Sodium, Chloride of.—This important substance constitutes the rock-salt of commerce, or common table-salt. (*See* SALT, COMMON.)

SODOM, APPLE OF, also called MAD APPLE.—This apple is mentioned by Strabo and others as found near the shores of the Red Sea, and is beautiful to the eye, but, if tasted, filling the mouth with bitter dust or ashes. It is, in reality, a kind of gall, produced by an insect (*Cynips insana*), and grows on dwarf oaks. The galls are 1½ inches in diameter, and of a rich, glossy, purple-red colour. This name is also sometimes given to a species of Solanum.

SOFT GRASS.—A genus of grasses (*Holcus*), of which there are but few species. The name is derived from the soft and abundant hair which covers them. (*See* HOLCUS.)

SOJA, *so'-za*.—In Botany, a genus of the natural order *Leguminosæ*. The legumes of *S. hispida* form the principal ingredient of the sauce called *soy*, which is imported from India in large quantities.

SOLANACEÆ, *so-lan-ai'-se-e*.—In Botany, the Potato family, a natural order of *Dicotyledones*, sub-class *Corolliflora*, thus defined by Bentley, according to the views of Miers, who places many genera usually included in this order in a distinct order called *Atropaceæ*:—Herbs or shrubs; leaves alternate, often geminate. Inflorescence axillary, or more frequently extra-axillary. Flowers isomerous. Calyx with 5, or rarely 4 divisions. Corolla regular, or nearly so, 5, or rarely 4-partite; æstivation valvate, or induplicate-valvate. Stamens equal in number to the lobes of the corolla, with which they are alternate, the fifth stamen very rarely sterile; anthers introrse, with longitudinal or porous dehiscence. Ovary usually 2-celled, rarely 3—5-celled; style simple; stigma clavate, or 2-lobed. Fruit capsular or baccate, 2 or more celled. Seeds numerous, albuminous, with the embryo straight, or curved in a more or less annular or spiral form. The plants of this order are scattered over various parts of the globe, except the polar circles, but are most abundant in the tropics. They frequently possess narcotic properties, but not by any means to the same extent as the plants belonging to the *Atropaceæ* of of Miers. (*See* CAPSICUM, SOLANUM.)

SOLAN GOOSE. (*See* GANNET.)

SOLANO, *so-lay'-no*. (*See* SIMOOM.)

SOLANUM, *so-lai'-num*.—In Botany, the typical genus of the natural order *Solanaceæ*. The tuber of *S. tuberosum* is the common potato, so largely used as food in temperate climates. The potato-plant is supposed to be a native of South America. It appears probable that it was first brought into Spain from the mountainous parts of South America, in the neighbourhood of Quito, early in the 16th century. From Spain, where the tubers were called *battatas*, it found its way to Italy, and thence to Vienna. The potato was first brought to England from Virginia by the colonists of Sir Walter Raleigh's expedition, who returned in 1586. Starch is largely obtained from potatoes, and is used for food under the names of English arrowroot, nutritious farina, &c. It is also employed in the preparation of dextrine, or starch-gum, which is much used in the arts. A decoction of the stem and leaves of the potato-plant has been used as an alterative in cutaneous diseases, and an extract of the herb has been also employed as a narcotic and antispasmodic. The medicinal properties of the plant are chiefly due to the presence of an alkaloid, called solanine, which has powerful narcotic properties. This has been detected in all parts of the plant; but in the tuber only traces of it are found, and these are entirely removed by the process of boiling and preparing potatoes for the table. Another interesting species of Solanum is *S. nigrum*, the black nightshade, which possesses alterative and narcotic properties. The fruit is said to be edible; but, if this be the case, its use for food requires caution, as it contains solanine. The fruits of several other species are, however, eaten in various parts of the world; as those of *S. Melongena* and *ovigerum*, called egg-apples; those of *S. quitoense*, called Quito oranges; and those of the Australian species, *S. laciniatum*, commonly known as kangaroo apples. The species *S. marginatum* has astringent properties, and is employed in Abyssinia in the process of tanning. *S. Pseudo-quina*, a Brazilian species, is used medicinally in South America as a febrifuge.

SOLAR CYCLE, *so'-lar.*—A term applied to one of those artificial periods made use of in chronological researches. It comprehends a period of 28 years, compounded of 7 and 4, the number of days in a week and the number of years in the interval of two leap-years. This cycle will remain undisturbed until the end of the present century; but in consequence of the year 1900 not being reckoned as a leap-year, the whole cycle will then be overthrown. It may, however, be re-constructed after 2000, that year being reckoned as leap-year; it will then last until 2100.

SOLAR ECLIPSE.—A phenomenon arising from the moon passing between the sun and the earth, the sun's rays being thereby intercepted, and the body of the luminary disappearing. In the case of a lunar eclipse, the phenomenon arises from the earth intercepting the light which its satellite ought to receive. On the other hand, an eclipse of the sun is due to the passage between earth and sun of the lunar body. During an eclipse of the moon, the phenomenon is the same wherever the moon is visible; but in the case of a solar eclipse, it depends essentially on the position of the spectator whether there be any eclipse at all. Suppose two persons placed at different parts of the earth during a solar eclipse, one may, in consequence of his position, see the whole body of the luminary obscured, whilst the other person may see nothing in the appearance of the solar body to denote that the moon is near it. A familiar illustration may explain this clearly. A screen placed before a candle may eclipse the candle from one person in the room, but not from another. Very often eclipses of the sun are only partial; frequently the eclipse is not total, through the moon not being near enough to hide the entire body of the sun. In this particular instance, a portion of the bright disc of the sun appears behind the dark body of the moon as a bright ring; this is called an annular eclipse. The luminous circle which surrounds the dark body of the moon when the sun is totally eclipsed is a most striking phenomenon. It forms a crown or corona of bright glory, of a pale silvery colour, similar in shape to that which painters love to draw round the heads of saints and angels. After observation, another appearance has been observed by astronomers. These are remarkable flame-like protuberances, which appear to issue from the moon's disc. Professor Airey states that one of them reminded him of a boomerang. Appearances so extraordinary as those presented by an eclipse could not fail to excite terror and astonishment in the imaginative minds of the ancient inhabitants of our globe; but although during recent times we have never witnessed any of those awful effects described by the ancients as produced throughout nature during the time of a total obscuration of the sun, yet even in the last observation the effect of totality upon the bystanders was most remarkable. "Until the beginning of totality, the murmur of conversation of many tongues had filled the air; but then in a moment every voice was hushed, and the stillness was so sudden as to be perfectly startling." So speaks Mr. Warren de la Rue, who observed the total eclipse of the sun, July 18, 1860, at Rivabellosa, in Spain. This gentleman succeeded in obtaining several splendid portraits of the phenomenon, which were shown in the International Exhibition of 1862.

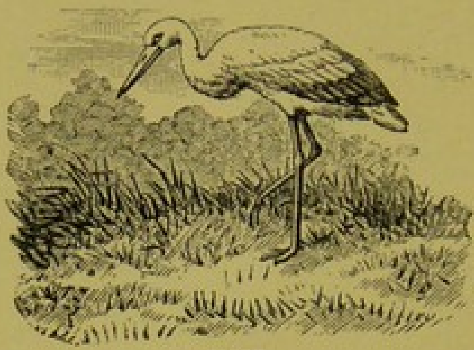
SOLAR SPECTRUM. (*See* SPECTRUM.)

SOLAR SYSTEM.—Signifies the sun, the planets which revolve round it, their satellites, together with those periodic comets whose returns have been successfully predicted. The solar system, according to the modern view, includes the Sun as a governing body, yet not as a fixed centre; Mercury, Venus, the Earth, with its one satellite the Moon, Mars, the group of minor planets, amounting at the present time to sixty-four, Jupiter and its four satellites, Saturn and its triple ring, Uranus with its four satellites, Neptune with its one satellite, and a large number of periodic comets. All these planets, accompanied by their satellites, together with numerous asteroids, move, as do also the comets, in elliptical orbits round the sun, which is situate in a focus common to them all; and by its mighty power of attraction, retains them in their orbits. The satellites, while revolving round the sun, likewise describe elliptic orbits round the primary planets. There is nothing more extraordinary in the whole phenomena of our system than the admirable regularity with which the planets are distributed in space. Before the discovery of the planets Ceres, Vesta, Juno, and Pallas, it had been ascertained that the distance of planets then known increased according to the following series:—Mercury 4, Venus 7, the Earth 10, Mars 16, suppossed planet (Asteroids) 28, Jupiter 52, Saturn 100, Uranus 196, Neptune 388. In this series, the wanting number, 28, led to the supposition that a planet between Mars and Jupiter was missing. This supposition was confirmed by the discovery of a large number of little bodies, whose mean distance from the sun fills up its place in the series as well as that of any other planet. (*See* ASTEROIDS.) The formula by which those distances are shown was discovered by Bode, and is consequently called Bode's Law (which *see*). Our solar system is thus described by Sir John Herschel:—

> If the sun be supposed a globe of 4 feet diameter, then Mercury is like a grain of mustard-seed 164 feet away; Venus a pea 284 feet away; the Earth a pea 430 feet away; Mars a rather large pin's head 654 feet away; Ceres, &c., grains of sand 1,000 to 1,200 feet away: Jupiter a moderate-sized orange a mile away; Saturn a small orange $1\frac{1}{4}$ mile away; Uranus a full-sized cherry or small plum $1\frac{1}{2}$ miles away; and Neptune a good-sized plum $2\frac{1}{2}$ miles away.

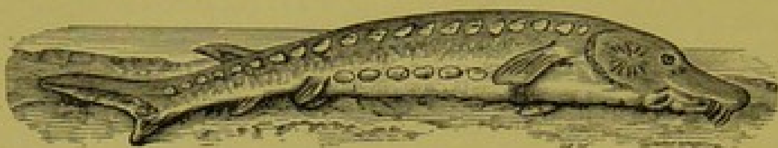
Supposing the radius of the sun to be divided into 1,000 parts, there would be in the radii of the several planets:—Mercury $3\frac{1}{2}$, Venus $8\frac{3}{4}$, Earth 9, Mars $4\frac{3}{4}$, Jupiter $97\frac{1}{2}$, Saturn 85, Uranus 39. Supposing the bulk of the sun to be divided into a *million* parts, Mercury would be somewhat less

TOBACCO.



STORK.

TAMARIND.



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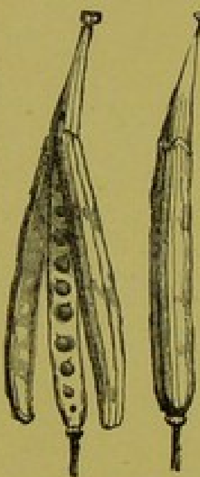

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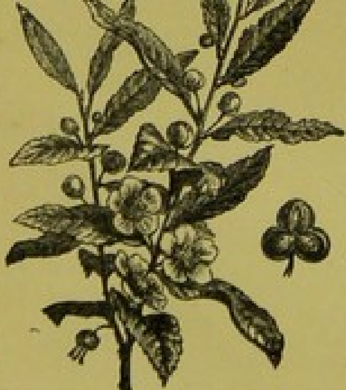

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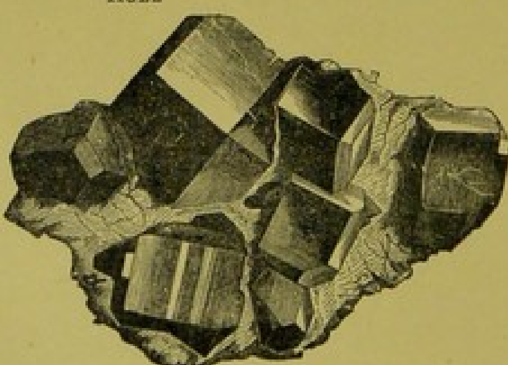


TIN, OXIDE OF.

TEAZLE.

than one-twentieth of one of the parts, Venus two-thirds of a part, the Earth three quarters of a part, Mars one-tenth of a part, Jupiter 925 parts, Saturn 720 parts, Uranus 58 parts, Neptune 120 parts. Respecting the moon, it is nearly the third part of Mercury in bulk. With regard to the masses of the planets, Cavendish declares that if we take the Earth to be at mean five-and-a-half times the density of water, or about half that of lead, the density of the Sun may be considered as equal to asphaltum, or rather heavy coal; Jupiter the same, Uranus and Neptune both of a substance somewhat heavier, Saturn of maple-wood, the Moon topaz or diamond; Mercury has been ascertained as having three times the density of the Earth, Venus nearly the same, and Mars about three-quarters as dense as the Earth. The period of time occupied by the sun in making a revolution about its axis is 25½ sidereal days. Mercury, Venus, the Earth, and Mars, all revolve in from 23½ hours to 24½; Jupiter revolves in about 10 hours, Saturn in about 10½ hours. As to the revolution upon their axis of Uranus and Neptune nothing is known. Respecting the distances of the planets from the sun:—Mercury is 37 millions of miles, Venus 68 millions, the Earth 91,328,600 miles, Mars 143 millions, Vesta 225 millions, Juno 254 millions, Ceres 263 millions, Pallas the same, Jupiter 490 millions, Saturn 900 millions, Uranus 1 billion 800 millions, Neptune 2 billions 483 millions. Until a short time since, the distance of the earth from the sun was set down as being 95 millions of miles. The distance of the moon from the earth is 240,000 miles. The great French astronomer Laplace, with the view of giving a possible explanation of the resemblance existing between the motions of the several planets,—they all revolving in one direction round the sun, their satellites moving in the same direction round themselves,—promulgated the idea called the Nebular Theory. He supposes that our solar atmosphere might once have extended to the limits of the system, and that the planets were thrown off successively in the form of nebulous rings, subsequently condensed into spheres from the equatorial parts of this vast revolving mass during its contraction. He ascribes to Saturn's ring a like origin. There is very little difference between the hypothesis of Laplace and that of Herschel, except the latter more prudently reserved his hypothesis for sidereal objects, and did not deduce from it a planetary cosmogony, we may regard the whole solar system as being subject to law and impassable limits; and thus permanence arises in the midst of change. Perhaps there is not in the whole range of modern astronomical discovery a more interesting and valuable fact than that many of the stars called fixed are subject to movement. The elder Herschel having examined the subject, announced that, like the stars, the sun and its attendant planets were also subject to a translation in space. He announced that the solar system was moving towards a point in the heavens near the star λ Hercules. These views have been confirmed by the subsequent researches of Sir William Herschel, Strave, Argelander, and others. The very latest view of the subject gives the motion of the sun and its planets as being at the rate of 150,000,000 miles yearly; and swift as this translation in space may appear, it is slow when compared with the motions of some of the hitherto considered fixed stars. The true theory of the revolutions of the solar system is due to Copernicus. (*See* COPERNICAN SYSTEM.)

SOLAR TIME. (*See* TIME.)

SOLE, *sole.*—The sole (*Solea vulgaris*) is distinguished from the flounder by having the mouth turned in an opposite direction with respect to the eyes, seemingly deformed, with teeth only on one side, and the front of the head almost always projecting. It inhabits the sandy shores all round our coast, where it keeps close to the bottom, feeding on the smaller testaceous animals and the spawn and fry of other fishes. As they seldom take any bait, they are caught almost entirely by trawling. The form of the body is a long oval, widest at a short distance behind the head; the colour on the upper side a dark brown, on the under side white.

SOLEN, *so-len.*—A genus of molluscs, the type of the family *Solenidæ*. The most common on the British coasts is the *Solen Siliqua*, which from its length and appearance is often called Razor Shell or Razor Fish.

SOLOMON'S SEAL. (*See* POLYGONATUM.)

SOLSTICE, *solz'-tis.*—In Astronomy, denotes that time when the sun is in one of the solstitial points—that is, when it is at its greatest distance from the equator; and is so called because he then appears to stand still, and not to change his distance from the equator for some time. There are two solstices in each year—the summer and the winter. The former is when the sun seems to enter the tropic of Cancer, which is on June 22nd, the longest day; the latter solstice is when the sun enters the first degree, or seems to describe the tropic of Capricorn, which is on December 22nd, the shortest day. This is only to be understood of the northern hemisphere; as in the southern, the sun's entrance into Capricorn makes the summer solstice, and into Cancer the winter solstice.

SOLUTION, *sol-u'-shun* (Lat., *solvere*, to untie).—If a liquid be poured on a solid, it often happens that their mutual attraction is sufficiently powerful to overcome the cohesion of the solid; its particles thus become disunited, combine with those of the liquid, and entirely disappear: this constitutes the chemical process of solution. Certain liquids are also soluble in other liquids, gases in other gases, and gases in liquids. In the case of the solution of a solid in a liquid, the latter is usually called the solvent, but sometimes the menstruum. Particular solutions have also particular names; thus, a solution of sugar is called a syrup, and a solution of a solid in alcohol a tincture. A liquid is said to be saturated when it can no longer dissolve further portions of a solid, that is, when the force of cohesion is exactly equal to that of adhesion. In most cases, however, an increase of temperature, by diminishing the cohesion, increases the solvent powers of the liquid. The uses of solution are many: through its means a body can be purified by filtration or crystallization, so that one substance can be separated from another, either by crystallization or the use of such fluids in succession as have a solvent power over any of the substances present.

SOMA.—The moon plant (*Asclepias acida*); also one of the most popular deities of the Vedic religion, in which it is held to be a god representing the plant. (*See* ASCLEPIAS, VEDIC RELIGION.)

SOMNAMBULISM, *som-nam'-bu-lizm* (Lat., *somnus*, sleep, and *ambulo*, I walk about).

—Literally and strictly signifies the walking in one's sleep; but it is commonly used in a wider sense, to denote that state of sleep or unconsciousness in which the mind retains its power over the limbs, but has no influence over its own thoughts. The controlling power of the will over the current of thought is entirely suspended, all the actions being directly prompted by the ideas which possess the mind. In some cases there is a coherent sequence in the succession of ideas, through which some one dominant impression may be traced, while in other instances it is more or less completely determinable by external suggestions. Among the various curious phenomena connected with this state, not the least remarkable is the peculiar power which suggestions derived from the muscular sense have in determining the current of thought. Thus, if the face, body, or limbs be brought into an attitude that is expressive of any peculiar emotion, the corresponding mental state is called up in correspondence to it: as, for instance, if the angles of the mouth be gently separated from one another, as in laughter, a hilarious disposition is immediately generated; and this may be made to give place to moroseness by drawing the eyebrows towards each other, and downwards upon the nose, as in frowning. In somnambulism proper, the individual gets out of bed, dresses himself, if not prevented; goes out of doors; walks frequently over dangerous places in safety; sometimes escapes by a window, and gets to the roof of a house; after a considerable interval returns, and goes to bed; and all that has passed conveys to his mind merely the impression of a dream. Frequently, during the paroxysm, the individual recollects circumstances which occurred during a previous attack, though there was no remembrance of them during the interval. It is unnecessary to speculate regarding the nature and cause of phenomena so obscure and so little understood.

SONCHUS. (*See* Sow Thistle.)

SOOSOO, *soo'-soo.*—A large fish of the Dolphin family (*Platanista*, or *Soosoo Gangeticus*), found in the river Ganges. It is interesting as being the only known existing species of its genus, and also as being a fresh-water cetacean. When full grown, it is about twelve feet long, and in its general form resembles the Dolphin. (*See* Dolphin.)

SORB. (*See* Service.)

SORGHUM, also SORGHO GRASS. (*See* Holcus, Durra.)

SOROSIS, *so-ro'-sis.*—In Botany, a collective fruit, formed of a number of separate flowers, firmly coherent into a fleshy or pulpy mass with the thalamus upon which they are situated. The pine-apple is an example; each hexagonal division represents a flower, while the crown of leaves above consists of empty bracts. The bread-fruit, jack-fruit, and mulberry are other examples. At first sight the mulberry appears to resemble the raspberry, but is totally different in origin and structure.

SORREL, *sor'-rel.*—A genus of plants (*Rumex*), natural order *Polygoneæ*. The Common Sorrel (*Rumex Acetosa*) is found in meadows, and is an agreeable salad; its stems and leaves are acid. It is a perennial, grows from one to two feet high, and has arrow-shaped leaves. Sheep's Sorrel is very similar. (For Wood Sorrel *see* Oxalis, Rumex.)

SOUARI NUT. (*See* Caryocar.)

SOULAMEA, *sool-lai'-me-a.*—In Botany, a genus of the natural order *Polygalaceæ*. *S. amara*, a native of Molucca, is intensely bitter, and is said to be a valuable febrifuge, and also a valuable remedy in cholera and pleurisy.

SOUND. (*See* Acoustics.)

SOW THISTLE.—The name given to a genus of plants (*Sonchus*) of the natural order *Compositæ*, suborder, *Cichoraceæ*. The common sow thistle is an annual plant having a height of two or three feet, a branching stem, and small yellow flowers.

SOYMIDA, *soy'-me-da.*—In Botany, a genus of the natural order *Erythroxylaceæ*. *S. febrifuga* is the rohuna or red-wood tree. Its bark is tonic, febrifugal, and astringent.

SPANIEL, *span'-yel* (Fr., *épagneul*).—A dog (*Canis familiaris extrarius*) of much antiquity, and one whose breed has been particularly attended to in various countries, particularly the Eastern. The distinguishing characteristics of the race are—a rather broad muzzle, remarkably long and full ears, the hair plentiful and beautifully waved, particularly that of the ears, tail, and hinder part of the thighs. The prevailing colour is liver and white; sometimes red and white, or black and white; sometimes deep brown or black on the face and breast, with a tan spot over each eye.

Varieties.—All the varieties of the spaniel are more or less elegant; and the spaniel has been divided into more varieties than any other dog. The true English-bred spaniel, called a springer, differs but little in figure from the setter, except in being not so tall. Their form is also more delicate, their ears longer, very soft and pliable, and covered with a coat of long waving and silky hair; the nose is red or black; the tail bushy and pendulous. The cocker, so called from his appropriation to woodcock-shooting, is a still smaller spaniel, and more compact in its frame, and his hair still more waved and curling than that of the springer. The water-spaniel (*Canis aquaticus*) is a sturdy spaniel with crisped hair, and with head rather larger and rounder than those of the land-spaniels. The Alpine, or St. Bernard variety of the spaniel breed, exceeds the others in size and beauty. It is generally two feet high at the shoulders, and full six feet from the nose to the end of the tail. The smaller spaniel King Charles's (*Canis brevipilis*), is a small variety of the spaniel used as a lap-dog. The Maltese dog and the lion dog (*Canis leoninus*) are small species of spaniel. The first is supposed to have sprung from the intercourse of the little spaniel with the smaller water-dog. It has the hair all over the body very long and silky, and generally pure white. The other has long silky hair about the head, neck, shoulders, and extremity of the tail, but on the other part short, giving the little animal a leonine appearance. The Newfoundland dog is placed by most authorities in the spaniel group, to which its form, its coat, and its hunting propensities, evidently entitle him.

SPAR, *spar.*—A general term applied to any bright crystalline mineral, such as fluor spar, calcareous spar, &c.

SPARROW, *spar'-ro* (Sax. *spearo*).—This well-known bird (*Fringilla domestica*), the constant attendant of civilized man wherever it is found, is common over the whole of the United Kingdom, including the islands of Orkney and Shetland, as also in Denmark, Norway, and Sweden, being more numerous in the last country, if possible, than with us. From thence, southward, its range is extended to Spain, Portugal, and North Africa; in the south-east it is found in Italy, Corfu, Dalmatia, and the Ionian islands. It is found, in fact, almost throughout the eastern continent, supporting equally well severe cold and extreme heat. Its voracity is extreme; and itis sometimes so numerous as to do great injury to the grain-fields. The beak of the adult male in summer is a bluish lead-colour; the top of the head a bluish-gray; over the ear-coverts, nape of the neck, back and wings, rich rufous brown, the centre of each feather nearly black; tail nearly square; the throat and chin black; the cheeks and sides of the neck grayish-white; breast dull grayish-brown, spotted with black; belly and under tail-coverts grayish-white. The whole length is rather more than six inches. The female has a brown beak; the head and neck of a uniform brown colour; the chin, throat, breast, and all the under surface of the body pale wood-brown. The sparrow forms its nest under the eaves of houses, in holes in the walls, or in any cavity which will afford sufficient space for it. Two or three sets of eggs are produced in the the season.

SPARROW-HAWK. (*See* FALCONIDÆ.)

SPASM, *spazm* (Gr. *spasmos*, from *spao*, I draw).—In Pathology is an involuntary contraction of muscular tissue, or that state of contraction of the muscles which is not spontaneously disposed to alternate with relaxation. When the contractions alternate with relaxation, and are frequently and preternaturally repeated, they are called convulsions. Spasms are distinguished as clonic and tonic; the contractions in the former alternating with relaxations, as in epilepsy, but in the latter remaining fixed, as in lock-jaw.

SPECIES, *spe'-sheez* (Lat.).—A term used in scientific classification to denote a group of such individuals as have an essential identity in all qualities proceeding from their alternate constitution or nature. The term employed to designate a collection of individuals which resemble each other more closely than they resemble any other plants, and which can be reproduced by seed. The following illustration is given by Professor Bentley:—"If we walk into a field of wheat, barley, or oats, we observe thousands of individuals which, though differing to a certain extent in size, and in some other unimportant characters, we at once associate together under a common name. In a like manner, we commonly observe around us, in gardens and fields, similar collections of individuals. Such collections of plants thus seen to resemble each other in all their important parts, constitute our first idea of species; and that idea is at once confirmed, if, by taking the seeds of such plants and sowing them, we obtain other plants resembling those from which such seeds have been obtained." Species under certain circumstances are liable to variations, but all varieties have a tendency to revert to their original specific type. A species is generally considered as a permanent production of nature, which is capable of varying within certain limits, but in no cases capable of being altered so as to assume the characters of another species. Sir David Brewster, Darwin, and his followers, hold a different opinion, and contend that species, so far from being immutable, are liable to change of almost any extent; in fact, that plants, by the operation of causes acting over a long period of time, may become so altered that they preserve scarcely any apparent resemblance to those from which they sprung.

SPECIFIC, *spe-sif'-ik* (Lat.).—In Medicine, is a remedy which acts on a particular organ, or uniformly checks any particular disorder. Thus, cinchona is a specific in certain kinds of intermittent fever.

SPECIFIC GRAVITY, OR SPECIFIC WEIGHT, *spe-sif'-ik*.—A term used to express the weight of a given bulk of any solid, liquid, or gas, as compared with some body taken as a standard; thus, taking a given bulk of water to consist of 1,000 atoms, an equal bulk of platinum will contain 23,000; of copper, nearly 9,000; of iron, about 8,000; and of glass, about 3,000; these numbers being in proportion to the specific gravity of the respective substances. The specific gravity of all substances, except the gases, is determined by a ready mode of weighing them in distilled water, after the celebrated principle of Archimedes. (*See* ARCHIMEDES, PRINCIPLE OF.) The specific gravity of a solid is ascertained by weighing the substance in air and in water. If the solid be heavier than water, it is first weighed in air, next immersed in water, it will appear to have lost weight,—this, too, being carefully ascertained. The weight of the substance in water is subtracted from its weight in air, the latter being divided by the difference, the quotient affording the specific gravity desired. If the substance be lighter than water, it is sunk in the water by being fixed to a solid heavier than water, —the weight of this heavy solid both in air and water being known. The compound is weighed both in air and water, the loss of weight being ascertained. Find the difference between this loss and the loss sustained by the heavy body when weighed alone in water; with this number divide the weight of the light body; the result will afford its specific gravity. The specific gravity of a fluid may be readily ascertained by comparing the weights of equal bulks of distilled water and of the fluid whose specific gravity is sought; for on dividing the weight of the fluid by that of the water the quotient will give the specific gravity. The specific gravity of a gas is ascertained in a manner similar to that of a liquid, except that atmospheric air is taken as the standard of unity. If a copper or glass flask, provided with a good stopcock, be weighed, firstly when filled with air, and secondly when exhausted as perfectly as possible by means of an air-pump, the difference of these weights will give the weight of air contained in the flask. If the flask be now filled with the gas under examination, and carefully weighed, this weight, after deducting the weight of the flask, will give the weight of the gas. The weight of the gas divided by that of the same bulk of air will afford the specific gravity of the gas as compared to air. The water used in determining the specific gravity of bodies should be taken at the convenient standard of 60° Fahr.

SPECTACLES, *spek'-ta-kles*.—Instruments for improving and aiding defective sight. They were invented in the 13th century, some say by Roger Bacon, and others by Alexander di Spina, a Florentine monk. (*See* SIGHT, OPTICS.)

SPECTROSCOPE. (*See* SPECTRUM ANALYSIS.)

SPECTRUM, *spek'-trum* (Lat., *specto*, I behold).—Is the term given to the coloured image of the sun when the light proceeding from it is transmitted through a prism and permitted to fall upon a screen. This fact of a decomposition, or separation into a system of pencils, of a single pencil of light, was first discovered by Newton, who admitted into a dark chamber, through a small aperture in a shutter, a pencil of white or undecomposed light. This pencil was refracted by means of a prism of glass, the image being thrown upon a screen in the shape of an elongated stripe of colours, called the prismatic spectrum. This stripe is made up of seven successive bands, of different colours, the lowest of which, or the least refracted portion, is red, orange, yellow, green, blue, indigo, and violet following. Between these different tints it is impossible to point out any distinct line of demarcation, the whole melting into each other. Dr. Wollaston was the first to discover lines in the spectrum. He observed two of these, and subsequently counted nearly a thousand. The relative positions of these lines had names assigned to them by Professor Fraunhöfer, whose name they bear. The sun, the planets, and almost every fixed star, have each their own system of lines. In the solar spectrum, the intensity of light appears to be greatest in the yellow band. The calorific powers of the spectrum increase from the violet to the red extremity. The chemical action of the solar spectrum appears to be greatest in the violet band, and in the dark space beyond.

Spectrum Analysis.—A method of determining the chemical constituents of substances by examining the spectra of their flames, as shown in an instrument devised for the purpose, called a spectroscope. It consists essentially of a tube, at one end of which is a convex lens, at the other an adjustable slit. Near the lens is placed a triangular prism, in such a position that the rays of light passing through the slit and convex lens may fall upon it at a certain angle, varying according to the refractive power of the prism. On the other side of the prism is a telescope of low magnifying power, which receives the rays refracted by it. A lamp of great heating power, but giving off little light, being placed before the slit, a portion of the substance under examination is burned in the flame upon a piece of platinum wire. The substance in burning gives the flame certain colours; these are refracted into their proper places on the spectrum by the prism, and examined by the telescope. It has been found that almost every element when burnt gives off light of a tint peculiar to itself. Thus sodium gives an orange light, refrangible into two lines of nearly equal colour. Potassium, which burns with a purple flame, produces, as might be expected, red and blue lines. Lithium also gives red and blue lines, but of a different tint, and in a different part of the spectrum. Calcium gives red, yellow, green, and blue; barium an almost infinite number of green; and so on. Spectrum analysis affords the means of detecting almost infinitesimal portions of various elements. Sodium, for example, may be detected in quantities not much more than the millionth of a grain. Since the practice of this branch of analysis has obtained amongst chemists, no less than three, perhaps four, new elements have been added to our already numerous list. Messrs. Bunsen and Kirchhoff, on examining the evaporated residue of a certain mineral water, noticed a new light blue line, which did not belong to any element with which they were acquainted. They rightly conjectured that it was caused by a new elementary substance, which they named cæsium, and which they shortly afterwards obtained in bulk from the same and other sources. In the same manner they discovered rubidium; and our own countryman, Mr. W. Crookes, F.R.S., added thallium to the list of elements. Of late years, great advances have been made in study with the spectroscope, until it is now, in fact, one of the most potent instruments of physical research at our command. Turned towards the sun, it is a very host of instruments in itself, and has enabled us to add very considerably to our knowledge of our great luminary. (*See* SUN.) The general reader will thank us for pointing out that Mr. Lockyer's "Studies in Spectrum Analysis" gives a vast amount of information on this subject in a comprehensive form.

SPECULUM, *spek'-u-lum* (Lat.)—In Optics, a reflector formed of polished metal, in distinction to one made of glass, to which the term mirror is generally applied. The Earl of Rosse, who was very successful in the production of large specula, says, in a paper published in the *Transactions of the Royal Society*:—"Tin and copper, the materials employed by Newton in the first reflecting telescope, are preferable to any other with which I am acquainted, the best proportion being 4 atoms of copper to 1 of tin (Turner's numbers), in fact, 126·4 parts of copper to 5·89 of tin." Copper in excess imparts a reddish tinge, while zinc in excess renders the fracture granulated and less white. When speculum metal is perfect, it should be white, glassy, and flaky.

SPEEDWELL, *speed'-well.*—A genus of plants (*Veronica*) belonging to the natural order *Scrophulariaceæ*. There are many British species.

SPERMACETI, *sper-ma-set'-te.*—A crystalline solid fat obtained from the oil found in the brain of the sperm whale, from which it readily crystallizes, especially in cold weather.

SPERMATOZOIDS, *sper-ma-to-zoidz'* (Gr., *sperma*, seed; *zoon*, an animal).—In Botany, small cells containing moving filaments, which have been detected in antheridia. They are also called *phytozoa* (Gr., *phuton*, a plant; *zoon*, an animal). Each spermatozoid is formed in a special cell, is rolled upon itself in a spiral manner, and escapes either by a pore or by a dissolution of the wall of the cell. Similar moving spores have also been observed in the thecæ and sporangia of many cryptogamia.

SPERM OIL, *sperm.*—The liquid portion of the fat of the spermaceti whale. The crude oil contains a small quantity of a peculiar oil, termed phocenine by Chevreul, which gives it a very disagreeable odour and taste, and traces of gelatinous matter. These impurities are removed by adding to the oil a solution of chloride of lime and a small quantity of decoction of oak-bark, after which it is agitated with a small quantity of sulphuric acid, clarified by subsidence and washed to remove adherent sulphuric acid. Sperm oil becomes semi-solid at 45° Fahr.

SPERM WHALE, OR SPERMACETI WHALE.—A species of whale (*Physeter macrocephalus*) found chiefly in the South Seas. In length, it comes next to the *Balæna Physalis*, but generally exceeds it in bulk. In commercial value it is nearly equal to the *Balæna Mysticatus*; for, although it does not possess the valuable whalebone of that animal, it furnishes us with the substance called spermaceti, and is rich in abundance with the finest oil. The sperm whale is also the source of the perfume termed ambergris. Its usual length is about eighty feet, and its circumference between thirty and thirty-five feet; although some have been caught exceeding even these dimensions.

SPIDER, *spi'-der.*—An insect (*Arachnida*) destitute of a distinct head, and wanting antennæ, in which one-half of the body is suspended from the other by a very slender peduncle, in which the integuments are so soft as not to bear the least pressure, whose limbs are so slightly attached to the body that they fall off at a very slight touch. The palpi resemble small feet without a claw at the tip, terminated at most in the females by a small hook, but in the males supporting various appendages, more or less complicated, connected with the function of reproduction in this family. The frontal claws are terminated by a movable hook, which curves downwards, and has on its under side a little slit for the emission of a poisonous fluid, which is secreted in a gland of the preceding joint. The thorax has upon it a like impression, indicating the region of the head; it consists of a single piece, to which is attached behind a movable and soft abdomen.

Spinning Apparatus of the Spider.—The abdomen is furnished with four or six nipples, fleshy at the tips, round or conical, jointed, placed close together, and pierced at the extremity with an immense number of minute orifices, or spinnerets, for the discharge of silken threads, which are produced from matter formed in internal reservoirs. The internal apparatus for secreting the silk is lodged within the abdomen near its posterior extremity, and consists of a small number (four or six, according to the species) of twisted, elongated, and unequal-sized vessels, being thickest at the middle, at the extremity of which are a great number of similar vessels, but of much smaller size, and considerably shorter, and which are pressed against each, uniting in a common base, which is in connection with the external apparatus. The matter discovered in the internal vessels is analogous to a gum or transparent paste. It is not soluble in spirits of wine or in water; it breaks when it is attempted to be bent, and, like glass, can only be made flexible when it is divided into very thin threads. This matter is discharged from several series of minute bristles, like points (spinnerules), surrounding the spinnerets, about one thousand to each spinneret. From these points there exude as many little drops of the above-mentioned liquid, which, becoming dry the moment it reaches the air, forms so many delicate threads. The threads of each spinneret first unite together, and then with those of the neighbouring spinnerets, to form a common thread; so that the thread of the spider, when it suspends itself from any object, is composed of an immense number of minute filaments. The first object which the spider has to accomplish is to attach her thread to some object as the commencement of a groundwork for her future operations. In doing this, it appears that she extends her spinnerets as widely as possible, presses them against the object to which it is intended that the thread should be attached, and then discharges a thread from each of the spinnerules. The insect uses her hind-legs as a reel to draw the threads out of her body. The spinnerets of the same spider differ in structure, one set of spinnerets being employed in producing threads which are glutinous, whilst another set produces threads which are smooth. It is by means of these threads that spiders construct the various webs which they throw from one object to another for the purpose of entrapping their prey, the glutinous threads being arranged in circles and the smooth threads being used as radii. (*See* BIRD-CATCHING SPIDER.)

SPIGELIA, *spi-jé'-le-a.*—In Botany, a genus of the natural order *Loganiaceæ*. The most important species is *S. marylandica*, the Carolina pink, wormseed, or perennial wormgrass. Its root and leaves are much employed in North America as anthelmintics. In larger doses they operate as irritant cathartics, and in poisonous doses as narcotics.

SPIKE, *spyke'.*—In Botany, that kind of inflorescence in which flowers are ranged round an axis, such as the catkin or the cone.

SPINA BIFIDA. (*See* SPINE.)

SPINACH, *spin'-aj* (Lat., *spinacia*).—A well-known pot-herb, extensively cultivated throughout Europe. (*See* CHENOPODIACEÆ.)

SPINE, SPINAL CORD, *spine* (Lat., *spina*, a thorn).—The spine, in Anatomy, is the long, articulated, bony column at the back of the trunk, extending downwards from the head its entire length. It forms the basis of support of the trunk, and connects all the other parts of the frame.

Description.—Its interior is hollow, and contains the spinal cord; its lower end rests on the pelvis. It is usually divided into two portions, a superior and inferior: the former flexible, and composed of twenty-four bones, or true vertebræ; the latter more fixed, and composed of nine bones, or false vertebræ. The true vertebræ are divided into cervical, dorsal, and lumbar; the false form the ossacrum and coccyx. Each vertebra consists of two parts, the body of the bone and the arch; the former being solid, convex before and concave behind; the latter being formed of two pedicles and two laminæ, supporting seven processes: namely, four articular, two transverse, and one spinous process. The bodies of the vertebræ are piled one upon another, forming a strong pillar for the support of the cranium and trunk; the arches forming behind a hollow cylinder for the protection of the spinal cord. Between each pair of vertebræ apertures exist, through which the spinal nerves pass from the cord. The several vertebræ are united together by means of a substance compressible like cork, which is firmest and hardest externally, and gradually becoming thinner and softer, till at length in the centre it is in the form of a mucous substance. There are likewise many strong ligaments which unite the bones of the spine to each other. The form and character of the different vertebræ differ considerably in the different parts: those of the neck are smaller in the body, and of a firmer texture, than those of the other parts; the dorsal vertebræ are of middle size between the cervical and lumbar, the upper ones more nearly resembling the cervical, the lower the lumbar, which last are larger than the dorsal. The first and second cervical vertebræ differ from the other vertebræ of the spine to allow of the various movements of the head. The first is called the atlas, from its supporting the head, and forms a kind of bony ring; the second the dentata, from the tooth-like process on the upper part of its body, which articulates with the former.

The Spinal Cord is that portion of the cerebro-spinal nervous system which is contained in the spinal canal. Its length is usually about sixteen or seventeen inches, terminating in the adult in a slender filament of gray substance about the lower border of the body of the first lumbar vertebra. It does not nearly fill the canal, its investing membranes being separated from the surrounding walls by areolar tissue and a plexus of veins. Its membranes are three in number. The most external is the *dura mater*, a strong filamentous membrane, which forms a loose sheath round the cord. The most internal is the *pia mater*, a cellulo-vascular membrane, which closely invests the entire surface of the cord; while between the two is the *arachnoid membrane*, an intermediate serous sac, which envelops the cord, and is then reflected on the inner surface of the dura mater. The surface of the cord is marked by two enlargements,—an upper or cervical, which is the larger, and extends from the third cervical to the first dorsal vertebra; the latter being situated opposite the last dorsal vertebra. In form, the cord is a flattened cylinder. Its anterior surface presents along the middle line a longitudinal fissure, called the anterior median fissure; and its posterior surface another, called the posterior median fissure. These fissures divide the cord into two symmetrical halves, which are united in the middle line throughout their entire length by a transverse band of nervous substance called the commissure. There are besides several lateral fissures very slightly defined. When cut transversely, the spinal cord is seen to consist of white and gray nervous matter. The former is situated externally, and constitutes its chief portion; the latter occupies its centre, and is so arranged as to present two crescental masses placed one in each lateral half of the cord, united together by a transverse band of gray matter,—the gray commissure. The posterior horn of each crescental mass is long and narrow, and approaches the surface at the posterior lateral fissure, near which it presents a slight enlargement; the anterior is short and thick, and does not quite reach the surface. The gray commissure connecting the two crescentic masses consists of a transverse band of gray matter, and of white fibres derived from the opposite half of the cord and the posterior roots of the nerves.

The nerves of the Spinal Cord consist of thirty-one pairs issuing from the sides of the whole length of the cord, their number corresponding with the intervertebral foramina through which they pass. Each nerve arises by two roots, an anterior and a posterior, the latter being the larger. The roots emerge through separate apertures of the sheath of dura mater, and directly after their emergence a ganglion is formed on the posterior root, the anterior root lying in contact with the anterior surface of the ganglion, but none of their fibres intermingling. Immediately beyond the ganglion the two roots coalesce, and by mingling their fibres form a compound or mixed spinal nerve, which, after issuing from the intervertebral canal divides into an anterior and posterior branch, each containing fibres from both roots. The spinal cord is a nervous centre, or rather an aggregate of many nervous centres, and has the power of conducting impressions or states of nervous excitement. Through it the impressions made upon the spinal sensitive nerves are conducted to the brain, where alone they can be perceived by the mind; and through it also the stimulus of the will applied to the brain excites the action of the muscles supplied from it with motor nerves. As a nervous centre, it has the power of communicating impressions from sensitive to moter nerve-fibres independent of the will, which is usually termed the reflex function of the spinal cord. Thus the movements of the pharynx and œsophagus are involuntary, for the will cannot arrest or modify them. A portion of food being conveyed by voluntary efforts into the fauces, is carried by successive involuntary contractions of the constrictors of the pharynx and muscular walls of the œsophagus into the stomach. These contractions are excited by the stimulus of the food on the sensitive nerves of the pharynx and œsophagus, conducted to the spinal cord, and thence reflexed through the motor nerves to these parts.

Diseases of the Spine.—*Inflammation.* The spinal cord, like other parts of the body, is subject to various diseases, one of the most common of which is inflammation, which may be either acute or chronic, affecting the cord itself or its membranes. It is characterized by pain more or less acute, extending throughout the length of the spine, or confined to a certain portion of it. It is much increased by every movement of the spine, and in many cases is more or less intermittent. It frequently also gives rise to spasmodic or paralytic affections of various parts. It is always a highly dangerous disease, and in general requires similar treatment with inflammation of the brain. (*See* BRAIN, DISEASES OF THE.)

Spina Bifida, or *Divided Spine*, consists in an imperfection of the posterior part of the spinal canal, and is almost always accompanied by an excessive secretion of the spinal fluid. It is almost always characterized by a tumour situated over the defective vertebræ, and varying in size according to the extent of the fissure in the spinal canal. It commences when the spine is being formed in fœtal life, and may continue for ten, or even twenty years, without affecting the general health; but the tumour is liable to inflame and ulcerate by friction, and thus produce death. A gentle pressure on the tumour, so as to resist the effusion of the fluid, is recommended.

Spine, Curvature of the.—Of this disease there are two forms: *Lateral Curvature* and *Angular Curvature*. The former is the more common, while the latter is the more serious, but both require prompt attention from a skilled physician. Rest and good food are the most essential elements to success in curing this complaint, and if the patient be not too old, the curvature nearly alway yields to skilful and intelligent treatment.

SPINDLE TREE, *spin'-dle.*—A genus of plants (*Enonymus*) of the natural order *Celastraceæ*, of which there are more than 250 species, all of them shrubs or small trees. The wood of the Common Spindle tree is fine grained and hard, and is used for fine articles of turnery.

SPINEL, *spy'-nel.*—A mineral consisting principally of alumina mixed with small proportions of silica, magnesia, and protoxide of iron. It is found in crystals, and is of various colours. Red spinels are often called Rubies.

SPIRÆA, *spi-re'-a.*—In Botany, a genus of the natural order *Rosaceæ*. The species *S. ulmaria* is the herb familiarly known by the name of meadow-sweet. Its flowers are remarkable for their fragrance, its roots for their tonic properties.

SPLEEN, *spleen* (Gr., *splen*).—In Anatomy, is a spongy viscus, of a livid colour, oval in figure, and situated in the left hypochondriac region, between the eleventh and twelfth false ribs. It is convex externally and concave internally, and its weight in the healthy adult is from four to ten ounces. It is largely composed of cells, but its internal structure is not well understood, neither have its uses been ascertained; but it would seem to be in some way of use to the stomach during the process of digestion. The ancients regarded it to be the seat of all ill-humours, as anger, melancholy, &c.; and hence the term splenetic applied to such as are cross and crabbed.

SPLINTS.—In Surgery, mechanical appliances used to keep the ends of fractured bones in as accurate and immovable position as possible during treatment. Splints are made of various substances, some of thin strips of light wood, some of gutta percha, some of leather, and some of plaster of paris.

SPONDIAS, *spon'-de-as.*—In Botany, a genus of the natural order *Anacardiaceæ*. The species *S. purpurea*, *S. Mombin*, and others, produce the fruits called hog-plums in the West Indies and Brazil. The fruit of *S. cytherea*, or *dulcis*, a native of the Society Islands, rivals the pine-apple in flavour and fragrance.

SPONGES, *spunj'-ez* (Lat., *spongia*, a sponge).—Certain marine productions, the family of *Spongiadeæ*, or *Porifera*, a division of animals of the class called *Protozoa*. For a long period it has been a disputed point as to whether sponges are animals or vegetables. In the "Principles of Zoology," by Agassiz and Gould, published in 1848, they are said to belong to the vegetable kingdom; but the most recent authorities are decidedly in favour of their animal nature. The texture of the ordinary sponge (*spongia*, Linn.) is cavernous and porous. Its great elasticity, and its property of imbibing and as readily parting with a large quantity of water, render it useful. In choosing sponge, it should be selected as light as possible, and free from stone, of as pale a colour as possible, with small holes, and fine and soft to the touch. The sponges of commerce are procured chiefly in the Mediterranean and the Bahama islands; they are mostly obtained by diving, to which persons are trained from childhood in the Grecian islands. The adhesion of the sponge to the bottom is generally firm and the growth slow. The coarse sponges used for horses and carriages are chiefly obtained from the Bahamas.

SPONTANEOUS COMBUSTION. (*See* COMBUSTION.)

SPORES, *spores.*—In Botany, the reproductive bodies formed by cryptogamous or flowerless plants, instead of seeds. A spore generally consists of a single cell, composed of two or more membranes, enclosing granular matter. Having no embryo, it can have no cotyledon, which is an essential part of the embryo; consequently, plants producing spores are said to be *acotyledonous.*

SPRAT, *sprat* (Ger., *Sprotte*).—This fish (*Clupea Sprattus*) was formerly confounded by naturalists with the young of the herring; it is now, however, generally admitted to be a quite distinct species. Its characteristics are as follows:—Proportions nearly the same as those of the herring, but the depth of the body is greater in proportion than in the young of that species; the gill-covers are not veined; the teeth of the lower jaw are so minute as to be scarcely perceptible to the touch. The dorsal fin is placed farther back, and the keel to the abdomen is more acutely serrated than in the herring. They inhabit the deep water round our southern coast during the summer months, and, like the other species of the genus *clupea*, they are wanderers: the shoals are capricious in their movements, and extremely variable in their numbers. Fishing for them begins early in November, continuing through the winter months; and the largest quantities are taken when the nights are dark and foggy. They are a cheap and agreeable food during all the winter months of the year, but are sometimes so plentiful as to be sold for manure to the farmers, who distribute about forty bushels of sprats over an acre of land, and sometimes manure twenty acres at a cost of twenty shillings an acre. A full-sized sprat measures six inches in length, and rather more than one inch and an eighth in depth. The tail is deeply forked; the scales are round, large, and deciduous. The upper part of the head and back are dark blue, with green reflections, passing into silvery white on the gill-covers, sides, and belly.

SPRING BOK. (*See* ANTELOPE.)

SQUARE ROOT OF A QUANTITY, *skwaire.*—A quantity which, being taken twice as a factor, will produce the given quantity. Thus the square root of 25 is 5, because $5 \times 5 = 25$. When the square root of a number can be expressed in exact parts of 1, that number is a perfect square, and the indicated square root is said to be commensurable. All other indicated square roots are incommensurable.

SQUILL, *skwill.*—A genus (*Scilla*) of *Liliaceæ*, of which there are about 72 species. They are bulbous plants, with radical linear leaves and usually blue flowers. The most familiar British species is the Blue Bell. The Squill used in medicine is the *Urginea Scilla*, formerly *Scilla Maritima*, and is found on the coasts of Africa, Canary Isles, &c. The drug is obtained from bulbs.

SQUINTING, *skwint'-ing* (Lat., *strabismus*).—In Medicine, is a disease of the eyes, in which they do not move in harmony with each other; hence the optic axes are not parallel, and a disturbance of vision is the consequence. Squinting may be confined to one eye, or it may affect both, and it may be in any direction. If the sight of both eyes is equally good, or nearly so, then all objects are seen double; but if the sight of one is much better than that of the other, the mind only attends to the more vivid impression, and disregards the weaker. Squinting is owing to some affection of the nerves or muscles of the eye. In most cases, it admits of cure by the operation of dividing the muscle by which the distortion is produced.

SQUIRREL, *skwir'-rel.*—A genus of quadrupeds (*Sciurus*) belonging to the *Rodentia*, or Gnawers, and distinguished from most animals of the tribe by the compressed form of the lower incisors. The upper lip is cleft, the fur soft and silky; the molar teeth are four on each side of the lower jaw, and five in the upper, the first of which is only a small tubercle, often shed with age; the incisors are two in each jaw; the toes are armed with hooked nails, by means of which they are enabled to climb trees, in the midst of which they pass their lives, feeding on fruit. They have fine full eyes, an elegant contour, great activity, and a long bushy tail. They are furnished with proper clavicles, and possess the use of the fore-arm and jaws in great perfection. The hardest nuts serve them for nutriment, and they cut through the shells with remarkable facility. They generally build nests of sticks and leaves in the tops of trees, and sometimes in hollow trunks. Previous to the approach of winter, they lay up large hoards of nuts and grain for future use. In feeding, they sit upon their haunches, and hold their food between their paws, while they work at it with their teeth.

Varieties of Squirrels.—The group of squirrels has been divided by some naturalists into ground squirrels (*Tamias*), flying squirrels (*Pteromys*), and tree squirrels (*Sciurus*). The ground squirrel has been separated by other naturalists from the true or tree squirrels on account of its having cheek-pouches. Its manners also differ altogether from those of the tree squirrels. It burrows in woody districts, in small hillocks, or near the roots of trees; but never makes its nest in the trunks or branches, although, when frightened, it climbs them with ease. The nest is reached by a winding tunnel, which is often of considerable extent. The head is longer than that of the common squirrel, and the roundish hairy tail is seldom turned up. (*See* FLYING SQUIRREL.)

STACKHOUSIACEÆ, *stak-how-ze-ai'-se-e.*—In Botany, a small natural order of *Dicotyledones*, sub-class *Calycifloræ*, consisting of two genera of herbaceous plants natives of Tasmania. The calyx is 5-cleft, with an inflated tube; the petals 5, united below into a tube, which arises from the top of the tube of the calyx. The properties of these plants have not been studied.

STAG, *stag.*—The male of the red deer; the male of the hind. (*See* DEER.)

Staghound.—The staghound and the largest foxhounds are said, by good authorities, to be identical species. However this may be, it is very certain that the modern staghound has been crossed with the foxhound, and that to this fact he owes a portion of his speed. In former times, the English staghound was a large and stately animal, equal, or little less, than the bloodhound; and originally, like that race, slow, sure, cautious, and steady. The modern hound is, perhaps, still handsomer, though somewhat smaller. It is still the largest hound in Britain. It has a large and rather short head, with a wide nose, loose, hanging, broad, and long ears, muscular hams, round small feet, and a rush tail, carried high. They were formerly rufous-coloured or glaucous, but are now invariably white, with some black and fulvous about the ears and on the sides or back, distributed in two or three large spots.

Stag-Beetles (*Lucanidæ*) derive their name from the large and powerful mandibles with which the males are furnished. The English stag-beetle (*Lucanus Cer-

vus) is the largest and most formidable-looking of all the British coleoptera. It inhabits the interior of oaks and beeches for several years before assuming its final transformation; and its larva is supposed by some to be the *cossus* of the Romans, a vermiform larva esteemed by them as a great delicacy. Stag-beetles remain hidden during the day and take flight at dusk. The females are sluggish, and not so numerous as the males, which fight with great ferocity amongst themselves for possession of their mates. When full-grown, the larva forms a cocoon of the dust of wood which it has ground down by its jaws, and after remaining some time as a pupa, undergoes its final transformation, to pass a very brief portion of its life as a perfect insect. Some of the foreign genera of stag-beetles are very brilliantly coloured.

STAMEN, *stai'-men* (Lat.).—The male reproductive organ of a flowering plant. It consists essentially of a case or bag, called the *anther*, containing a powdery substance, called the *pollen*, which is discharged at certain periods through little holes or slits. The anther is generally supported on the summit of a little column or stalk, called the *filament*. This is not an essential part of the stamen, being often wanting; in which case the anther is said to be sessile. The stamens constitute the whorl or whorls of organs situated on the inside of the corolla.

STAMMERING, *stam'-mer-ing* (Ang.-Sax.).—A term which is commonly used in a somewhat wide and indefinite sense to signify all kinds of defective utterance. Strictly, however, it denotes a difficulty or inability to enunciate certain elementary sounds; while stuttering is an inability to enunciate words and sentences fluidly. The former may be regarded as mainly an organic or symptomatic affection, the latter chiefly an idiopathic or functional one. Defective utterance may arise from malformation of the organs of speech, inflammation or enlargement of the tonsils, or suchlike, or from some general or local affection of the nerves of the vocal organs. Frequently, also, it is the result of bad habit or imitation. In stuttering, the stoppage generally takes place at the first syllable of a word, but sometimes it may be at the second or third. It is not a little remarkable that most stutterers can sing without difficulty; the reason being that so frequent changes do not take place in the vocal organs. Hence we have an important means for the cure of this intractible affliction. The stutterer should commence by giving leisurely and fully every word. To aid in this, some have recommended motions of the hands or feet to accompany each sound. In fact, the art of speaking has to be really learned from the beginning, from syllables up to words and sentences. Cheerful society, healthy mental occupations, athletic sports, and attention to the general laws of health, are of the utmost importance in such cases. As a general rule, everything that increases the control of the mind over the muscles improves the speech, and *vice versâ*.

STAPHYLEACEÆ, *stai-fil-e-ai'-se-e.*—In Botany, is the Bladder-nut family, a natural order of *Dicotyledones*, sub-class *Calyciflorœ*. Shrubs with opposite, or rarely alternate leaves, pinnate, and furnished with deciduous stipules. Calyx 5-parted, coloured. Petals 5, alternate with the divisions of the calyx. Stamens 5. Ovary superior, composed of 2 or 3 carpels; ovules numerous; styles 2 or 3, cohering at base. Fruit fleshy or membranous. There are but 3 genera and 14 species, which are scattered irregularly over the globe. The bark of some species is bitter and astringent; the seeds of others are oily and purgative.

STAR, *star* (Sax. *steorra*).—A general term applied to any celestial body, including the planets. In Astronomy, however, the word is used to designate only those self-shining bodies which are situated beyond the limit of solar attraction. They are also called fixed stars, to distinguish them from the planets, comets, satellites, &c. Astronomy inquires into the distance, number, magnitude, nature, and motion of the fixed stars.

Magnitudes of Stars.—In appearance, the magnitudes of the stars seem to differ greatly; but this variation is attributed to the difference in their distances. It is impossible to tell their number. In order to establish a gradation among them, and for convenience in description or reference, astronomers divide them into classes or orders, called magnitudes. The most brilliant are called stars of the first magnitude; those less brilliant are styled of the second magnituge; and so on, to the sixth or seventh, when they become invisible to the naked eye. The stars are very irregularly distributed throughout the heavens; in some parts considerable regions are to be found with scarcely a single star, while other portions, like the milky way, are crowded. (*See* MILKY WAY.) In all ages, the distance of the fixed stars from the earth has been a subject of interest and inquiry. In determining the question of *parallax*, the star 61 Cygni was selected as being a star with a large proper motion. The experiment turned out favourably, and the parallax was discovered, and with it roughly the distance of the star from the solar system. This was estimated at about 592,000 times the mean radius of the earth's orbit. The difference between stars and planets may be summed up thus: stars shine by their own light, and they may commonly be distinguished from planets by their flickering light, and when viewed by even the most powerful optical instruments, by their inappreciable diameter. There are said to be 5000 stars visible to the naked eye.

STARCH, *startsh* (Sax., *stearc*).—Chemically speaking, starch consists of $C_{12}H_{10}O_{10}$. It is readily distinguished from other similar substances by the deep blue colour it assumes on the addition of free iodine to its solution. Boiled with dilute sulphuric acid, it becomes converted into dextrine, or British gum, without any change in its chemical composition. It then gradually assumes the elements of water becoming changed into glucose, or grape sugar. Starch consists of a number of ovid grains, built up of a series of skins, one over the other, like an onion. With cold water, starch forms only a granular paste, but with hot water the granules burst and dissolve, giving rise to a glutinous viscid solution, which, when dry, forms a translucent horny mass. Hence its use in stiffening linen. In the manufacture of starch from potatoes and cereal grains, advantage is taken of its insolubility in cold water. The material most used in starch-making is rice, which contains between 80 and 90 per cent. of amylaceous matter.

STAR-FISH.—This animal (*Asterias*) has a suborbicular depressed body, its circumference divided into lobes or rays, each of which has a longitudinal furrow on its lower side; and this furrow is pierced laterally with small holes, through which pass the feet or tentacula, which are membranous, cylindrical, and each of them terminated with a little disc, which performs the office of a cupping-glass. By shortening or elongating these numerous little organs, the progressive motions of the star-fish are regulated. Its powers of reproduction are considerable; for if by any violence a ray be broken off, a new one will shortly be produced. The mouth is armed with bony teeth, with which the animal seizes and crushes the shell-fish on which it feeds. Some of the species attain an enormous size.

STARLING, *star'-ling.*—A genus of birds (*Sturnus*) belonging to Cuvier's great order *Passeres*. The characters of the genus are these: the bill straight, conical, depressed; four toes on the feet, three to the front, and one to the rear; the wings long, the first quill little more than rudimental, and the second and third the longest in the wing. The starlings are noisy but social birds, being generally found together in flocks, more or less numerous, and they can be taught to articulate. The common starling (*Sturnus vulgaris*) is about eight or nine inches in length. The upper parts of the plumage are black, with reflecting glosses, which vary from green to purple, according to the light in which they are seen. The quills and tail feathers are blackish, with ash-coloured borders, and the under coverts of the tail have broad borders of a whitish colour. They are partly migratory and partly not.

STATICS, *stai'-tiks* (Lat., *statice*).—That subdivision of mechanics which treats of bodies at rest, in opposition to dynamics, which treats of bodies in motion. The two great propositions of statics are the principle of the lever, and the principle of the composition of forces. Archimedes demonstrated the first, namely, the equilibrium of a straight horizontal lever loaded at its extremities with weights which are reciprocally proportioned to their distances from the fulcrum. The second general principle consists in this, that any two forces acting together upon the same point of a body are equivalent to a single force, represented in intensity and direction by the diagonal of a parallelogram, of which the two given forces are represented by the sides. This principle was not known to the ancients. Newton proved it to be true generally, and shows how the laws of equilibrium may be deduced from it, in the second corollary to the third law of motion. (*See* GRAVITY, FORCE, PHYSICS.)

STEAM, AND STEAM-ENGINE, *steem* (Sax.).—Steam is the vapour given off by water when its temperature is raised to such a degree as to cause it to pass into a state of ebullition. The mechanical properties of steam are similar to those of gases in general. In its natural state it is transparent and colourless; its visibility in air is caused by its partial condensation. In the case of steam, the most important mechanical property to be considered is the elastic pressure. When confined in a close vessel, a gas or vapour will press upon the interior surface of the vessel with a power arising from the elasticity of the fluid. This pressure is uniformly distributed over every part of the inner surface of the vessel in which the fluid is contained. All the mechanical force of steam arises from this property.

Laws affecting the formation of Steam.—First, the temperature of the boiling-point of a liquid is the same at all times under the same pressure, and in a vessel of the same substance. Second, the temperature of the liquid remains constant during ebullition, provided the pressure remain the same; and if a greater quantity of heat be applied to the vessel containing the liquid at one time than another, the only result will be that a larger quantity of steam will be given off: the temperature of the liquid will not be increased. Third, the volume of the steam will be much greater than that of the liquid which supplies it, and the volume of the vapour of water will be about 1,700 times greater than that of the water itself. Water evaporates at all temperatures; but the law with respect to ebullition was ascertained by Dalton. It lays down that "the elastic force of the vapour given out during the process is equal to the external pressure. This allows us to calculate the elastic force of the steam from the temperature at which ebullition takes place, from tables showing the elastic force of steam at different temperatures. The boiling-point of a liquid is not affected by substances held in suspension; but when substances are held in solution they produce very decided effects. Salts dissolved in water retard its ebullition. The boiling-point of water is 212°; while that of sea-water, containing $\frac{1}{33}$ of its own weight of chloride of sodium, boils at 213·2° in the open air. After the production of steam, it acts according to fixed laws. First, under ordinary atmospheric pressure, a cubic inch of water is converted into a cubic foot of steam. Second, under the same pressure, a cubic inch of water, evaporated, gives a mechanical force equal to that which would raise a ton weight to the height of one foot. The following facts have also been ascertained within very small limits of error. Under the pressure of 35 lbs. on the square inch, and at the temperature of 261°, steam exerts a force equal to a ton weight raised one foot; under the pressure of 15 lbs., and at 213°, it is 2,086 lbs., or nearly seven per cent. less; and under 70 lbs., at 306°, it is 2,382 lbs., or nearly 6½ per cent. more than a ton raised a foot. The relations between the elasticity, temperature, and density of steam, have long been important subjects of philosophical research.

Steam-Engine.—When an efficient mechanical power is produced by the generation, or generation and condensation, of the steam or vapour of any liquid, the combination of vessels and machinery for that purpose is called a Steam-Engine. For a considerable period after its invention, this machine was called a fire-engine; and not improperly, for the principal agent is heat or fire. Steam-engines vary in their size, in their proportions, and in their form, as well as in the mechanical details by which the power of steam is adapted to their action.

STEARIC ACID, *ste'-ar-ik* (Gr. *stear*, fat).—This fatty acid is liberated during the saponification of most animal and many vegetable fats. (*See* FATTY ACIDS.) It may be obtained pure by saponifying mutton suet and decomposing the hot solution of the soap with hydrochloric acid. The oily and fatty acids separated are next submitted to pressure between hot plates, by which means the oleic acid is separated. Recrystallization from alcohol and ether, three or four times, gives the pure acid separate from its congeners. The stearates of the alkalies are soluble in water. Stearate of soda is the basis of ordinary hard soap; stearate of potash, on the contrary, is soft. The other stearates are insoluble. Stearate of lead is one of the constituents of lead or diachylum plaster. Stearic acid is insoluble in water, but is soluble in ether and alcohol, from which it crystallizes in beautiful colourless transparent rhombic plates. Its solution reddens litmus. Ordinary so-called stearic candles consist of stearic acid, combined more or less with palmitic acid, according to the raw material used in their manufacture.

STEARINE, *ste'-a-rin* (Gr., *stear*, tallow).—A white crystalline neutral fat, existing in most oils and fats. It forms the largest constituent of mutton tallow, from which it may be separated by heating that substance with ten times its volume of ether. When cool, the olein and palmitin are held in solution, and the stearine crystallizes out in pearly scales. These must be pressed between blotting-paper or dissolved in ether, and re-crystallized until the melting-point is constant. Stearine exists under several modifications, each having a different melting-point.

its average melting-point is 144° Fahr. Stearine is a salt composed of three equivalents of stearic acid united with one of the base of glycerine.

STEATITE. (*See* TALC.)

STEEL, CHEMICAL COMPOSITION OF.—Within the last few years, great attention has been paid to the investigation of the chemical composition of steel. The researches of Despretz, Fremy, and others, tend to the conclusion that nitrogen exercises a very important influence over the phenomena of steeling, and that carbon plays a less necessary part, while those of MM. Caron and St. Claire Deville still refer the formation of steel to the chemical combination of iron with carbon.

Various Improvements in Steel Manufacture have been made by Marcus Lane of Washington and M. Riepe of Westphalia, but that which is now used most extensively in England was introduced by Sir Henry Bessemer. (*See* BESSEMER'S PROCESS, and IRON.) Marcus Lane has recently taken out two patents for improvements in the manufacture of iron and steel.

STELLARIA, *stel-lai'-re-a* (Lat. *stella*, a star, from the appearance of its flowers).—In Botany, a genus of the natural order, *Caryophyllaceæ*. Many of the species are common weeds, being known as stitchworts. *S. media* is the chickweed.

STEM, *stem* (Sax., *stefn* or *stemn*).—The ascending axis of a plant, or that part of the axis which at its first development takes an opposite direction to the root. Stems have usually considerable firmness and solidity, but sometimes they are too weak to support themselves. When they trail on the ground they are said to be procumbent; when they cling to other bodies by means of suckers, climbing or scandent; and when they twist in a spiral manner round their supports, twining or voluble. The four principal kinds of stem are:—1. the caulis, common to plants which are herbaceous, or which die annually,—examples may be seen in most garden and roadside plants; 2. the trunk, the woody and permanent stem of a tree,—it always springs from a dicotyledonous embryo; 3. the culm, common to most grasses and sedges,—it is usually a slender tube, having joints or partitions at the points where the leaves arise; 4. the stipe, a fibrous stem, straight and cylindrical, being almost as thick at the summit as at the base,—it is peculiar to acotyledonous plants, and may be observed in any of the palms or tree-ferns. (For description of the principal modifications of the stem, *see* BULB, CORM, RHIZOME, TUBER.)

STERCULIA, *ster-ku'-le-a.*—In Botany, the typical genus of the natural order *Sterculiaceæ*. The most interesting species is *S. acuminata*, the seeds of which, under the name of Kola-nuts, are used in Africa to sweeten water which has become more or less putrid. They contain a large amount of mucilage. *S. Tragacantha*, a native of Sierra Leone, received its specific name from yielding a gum resembling flaky tragacanth. *S. urens*, a native of Coromandel, yields a gum of a similar nature, which is known as gum kutteera. The seeds of all the species contain fixed oil, and many are eaten in different parts of the globe.

STERCULIACEÆ, *ster-ku-le-ai'-se-e.*—In Botany, the silk-cotton family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*, consisting of trees and shrubs, easily recognized by their valvate 5-parted calyx, contorted corolla of 5 distinct petals, numerous perfect stamens united by their filaments into a column, and 2-celled extorse anthers. There are 37 genera and 128 species, all natives of the tropics, or of very warm climates. In their properties they resemble the *Malvaceæ*, being generally mucilaginous, demulcent, and emollient. Some produce seeds with a hairy or cottony covering, and others yield useful fibres. Many are remarkable for their prodigious size, height, and apparently enormous age. (*See* ADANSONIA, BOMBAX, DURIO, STERCULIA.)

STEREOSCOPE, *ste'-re-os-kope* (Gr., *stereos*, solid; *skopos*, view).—An instrument by means of which two pictures, taken from different points of view, are shown as one picture, and has the almost magical appearance of solidity.

The Theory of the Stereoscope was first explained by Professor Wheatstone, who showed that the image of every solid object painted on the retina is different with every different position of the eye. To illustrate this by means of the common camera obscura:—If the image of a picture be formed in this instrument, it is of no consequence in what position the instrument is fixed with regard to the picture, the relative position of all its points will be the same; but when a solid object, as a castle, or a tree, is depicted in the camera, the case is far different. It will then be observed that the relative position of the several points of the solid image will vary every time the instrument is shifted. It is precisely similar with the eye; a different picture is painted on the retina every time the position of the eye is changed. In obedience to this law, two slightly different pictures of any solid object will be simultaneously impressed on the two eyes. That this is actually the case, we may convince ourselves by placing a lighted candle about three feet in front of the face, and holding up the fore-finger between the candle and the nose; the finger and candle will appear on the contrary sides of each other when seen by each eye separately. Professor Wheatstone showed that the combination of two dissimilar visual images simultaneously depicted on the two retinæ, conveyed to the mind the perception of relief or solidity, and this fact he proved by explaining that if two pictures of an object be taken in the direction in which it would be viewed by the two eyes separately, upon these pictures being presented to the two eyes in such a way that their images might fall on corresponding portions of the retinæ, then the two views would be combined into one, and carry to the mind of the beholder the impression of actual solidity. The refracting stereoscope was subsequently described by Sir David Brewster, in a paper communicated to the Royal Society of Edinburgh. It would appear, however, that the dissimilarity of the pictures, as observed by each separate eye, is not a modern discovery. Two thousand years ago, it was recognized by Euclid and described by Galen. In 1593, Porta revived it; it was known to Leonardo da Vinci and Harris in 1775, and later, Drs. Smith and Porterfield were aware of the fact. But it was not till photography and the binocular camera were invented that accurate pictures, as seen by each separate eye, could be properly united so as to afford the idea of solidity.

Different kinds of Stereoscopes.—(1.) *The Reflecting Stereoscope.* Professor Wheatstone's original instrument, the reflecting stereoscope, is a very simple instrument. It consists of two small plane mirrors, placed vertically and at right angles to each other in the middle of a horizontal board, at the ends of which are fixed two vertical frames provided with grooves for holding two pictures drawn on cardboard. The eyes of the spectator are placed in front of the mirrors, so as to observe one of the pictures reflected from each, the card-boards being so adjusted in the grooves that the images shall exactly overlap each other, upon which the stereoscopic effect will be discovered. (2.) *The Refracting Stereoscope* consists of a pyramidal box of wood, metal, or other opaque material, blackened on the inside, and having a lid for the admission of light. The bottom of the box is usually formed of ground glass. The top of the box consists of two portions, in one of which is the right-eye tube, containing a semi or quarter-lens; the other, or left-eye tube, containing also a semi or quarter-lens. These lenses should be made to draw out, in order to suit long and short-sighted eyes. The stereoscopic pictures, or "slide," are generally mounted upon a thick card, and are fitted into a groove at the bottom of the box. Upon looking through the eye-tubes at the two dissimilar pictures upon the slide, they are found to be united into a single picture, possessing the appearance of relief and solidity.

STERNUM, *ster'-num* (Ger., *sternon*).—The breast-bone, an oblong, flat, irregularly-shaped bone, placed at the forepart of the thorax. In the young it consists of a number of bones, which become united in the adult, when it consists of three, and sometimes of two, or even of one bone. It serves for the articulation of the seven upper or true ribs on each side, is of use in aiding respiration, and defends the heart and lungs.

STETHOSCOPE, *steth'-os-kope* (Gr., *stethos*, the chest, and *skopeo*, I explore).—The name of an instrument invented by M. Laennec, of Paris, in 1823, and is of valuable aid in the process of auscultation (which *see*). It consists of a tube about ten inches in length, made of wood, or sometimes of gutta-percha, widening considerably at one end, and but slightly at the other. The wide end is applied to the chest or other part of the patient, the physician putting his ear to the other end; and from the sounds emitted by the heart, lungs, &c., the state of these parts may be ascertained. Of late years, the double stethoscope, invented by Dr. Camman, of New York, has come into extensive use.

STICKLEBAT, OR STICKLEBACK, *stik'-el-bat.* — The common English name for certain small fishes constituting the genus *Gasterosteus*, of Linnæus, and containing both fresh and salt-water species. The rough-tailed three-spined sticklebat is one of the smallest as well as the most common of our fishes, being found in every river, brook, and lake, and being common all round the coast. It is active in its movements, pugnacious in the extreme, and extremely voracious. Its food consists of worms, insects, and the minute fry and roe of other fishes. It spawns in summer; the females, generally paler in colour than the males, depositing their ova, which are large but few, on the leaves of aquatic plants. They are so numerous that they are frequently strewed over the land as manure. This species seldom exceeds two and a half inches in length, and is distinguished by having its sides defended by a series of bony plates, arranged vertically along their whole length. The colour of the back is green; the cheeks, sides, and belly, silvery-white. Another species of sticklebat is the fifteen-spined sticklebat, which seldom, if ever, is found in fresh water, and sometimes attains the length of six inches.

STICTA, *stik'-ta.*—In Botany, a genus of lichens. *S. pulmonaria*, commonly known as tree lung-wort, or oak-lungs, possesses tonic and nutritious properties. In Siberia it is used instead of hops for imparting bitterness to beer. A brown dye is produced from it in France.

STILAGINACEÆ, *stil-a-gin-ai'-se-e.*—In Botany, the *Stilago* family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*, consisting of trees or shrubs, with alternate simple leathery leaves, having deciduous stipules; minute unisexual flowers, growing in scaly spikes; and drupaceous fruits. There are five genera and about twenty species, natives of Madagascar and India. Their fruits are commonly sub-acid and edible. No injurious properties are known to exist in the plants of this order.

STILBACEÆ, *stil-bai'-se-e.*—In Botany, a small natural order of *Dicotyledones*, sub-class *Corolliforæ*. There are three genera and seven species, natives of the Cape of Good Hope. They are shrubby plants, without any known uses.

STILLINGIA, *stil-lin'-je-a.*— In Botany, a genus of the natural order *Euphorbiaceæ*. The species *S. sebifera* is called the Chinese tallow-tree, from its seeds being covered by a white sebaceous substance, which, when separated, is found to be a pure vegetable fat: it is used for making candles. *S. sylvatica*, queen's root, is employed in North America as an emetic, cathartic, and alterative.

STIPULES, *stip'-yules.*—Projections at the base of a leaf, or leaf stalk. (*See* LEAF.)

STINGING-NETTLE. (*See* LOASACEÆ, NETTLE AND URTICA.)

STOCK FISH, *stok'.*—A name used in commerce to designate salted and dried cod-fish or similar species of fish.

STOMACH, *stum'-ak* (Gr. *stomachos*, also *gaster*).—In Anatomy, is the large membranous receptacle, which receives the food from the œsophagus, and within which it is acted upon by the gastric juice and converted into chyme. It is situated in the left hypochondriac and epigastric regions, and when distended, it has the shape of an irregular cone, having a rounded base and being curved upon itself. The left extremity is the larger, and is called the greater splenic end of the stomach, the right or small end being called the pyloric. The œsophagus terminates in the stomach two or three inches from the great extremity by the cardiac orifice; while by the pyloric orifice at the other end the digested matter enters the duodenum. When moderately filled, the stomach is about ten or twelve inches in length, and its diameter at the widest part about four inches. The walls of the stomach consist of four distinct coats, held together by fine areolar tissue, and named, in order from without inwards, the serous, muscular, areolar, and mucous coats. By some the areolar is not reckoned a distinct coat. The first of them is a thin, smooth, transparent, elastic membrane derived from the peritoneum. The muscular coat is very thick, and composed of three sets of fibres, the longitudinal, circular, and oblique, which form three layers. The areolar and fibrous coat is a tolerably distinct layer placed between the muscular and mucous coats, and connected with both. The last is a smooth, soft, rather thick and pulpy membrane, loosely connected with the muscular coat, and covered with exhaling and inhaling vessels. At the pyloric orifice leading from the stomach into the duodenum, there is a sphincter muscle which contracts the aperture and prevents the passage of any matter into the intestines until properly digested. The food is propelled along the œsophagus, and enters the stomach in successive waves through its cardiac orifice. It is there subjected to a peculiar peristaltic motion, having for its object to produce a thorough intermixture of the gastric fluid with the alimentary mass, and to separate that portion which has been sufficiently reduced from the remainder. This motion causes not only a constant agitation or churning of the contents, but also moves them slowly along from one extremity to the other. These revolutions are completed in from one to three minutes, being slower at first than after chymification has more advanced. The passage of the chyme or product of the gastric digestion through the pyloric orifice into the commencement of the intestinal tube is at first slow; but when the digestive process is nearly completed, it is transmitted in much larger quantities. (*See* DIGESTION, GASTRIC JUICE.)

STOMATA, *stom-ay'-ta.*—The little "mouths" on the leaves of plants, by which they "breathe." (*See* LEAVES.)

STONE, *stone* (Sax., *stan*).—A general term applied to a hardened mass of earthy matter. In the building art there are very few subjects of greater practical importance than the selection of stones naturally fit for the purposes required. A good building-stone ought to possess great powers of resistance against crushing and breaking weights; it should be of even grain, and capable of furnishing large blocks; its constituent parts should not be susceptible of decomposition by the action of the atmosphere, or by their mutual reaction upon one another; it should absorb neither water or vapour, except to a slight extent; and, as far as possible, it should be of an homogeneous nature. The denser stones, as a general rule, are more durable than the lighter ones. (*See* QUARRY.)

Stone.—In Medicine. (*See* CALCULUS.)

Stone, Artificial.—A manufactured substance made to resemble stone, and used for statuary and other decorations of architecture.

Feilner Stone.—M. Feilner, at Berlin, has for several years made artificial stone with great success. His materials are almost similar to those used in making English pottery, and the plastic mass is either formed in moulds or by hand. The kilns in which the mixture is baked are peculiar in form, and are built so as to economize the fuel.

Ransome's Patent Silicious Stone is made thus:—Ten pints of sand, one pint of powdered flint, one pint of clay, and one pint of alkaline solution of flint. These ingredients are first well mixed in a pug-mill, and kneaded till they are thoroughly incorporated, and the whole mass becomes of a uniform consistency. When well-worked with clean materials, the compound possesses a putty-like consistence, and is capable of receiving sharp and delicate impressions. The mixture is afterwards baked in kilns constructed for the purpose. This kind of artificial stone can be used for a great variety of purposes.

Béton-Coignet, an artificial stone introduced by M. Coignet of Paris, is perhaps simpler in manufacture, and is of very high quality. Its usual ingredients are Portland cement, silicious hydraulic lime, and clean silicious sand mixed with a little fresh water. Common lime may be used instead of the hydraulic lime, in which case a little more Portland cement must be added.

Stone, Building. (*See* BUILDING-STONE.)

Stone, Preservation of.—Stone, in common with every other material used in construction, is liable to either failure or decay from chemical or mechanical causes. Granite, though the hardest of building-stones, is, in several of its varieties, liable to serious decomposition. Many qualities of granite suffer rapid decomposition by the sea. Limestones also suffer from the same cause. Changes of temperature have a great effect upon stones containing iron, though some varieties containing iron in a high state of oxidation, as rosso-antico, porphyry, and others, are not readily acted upon by the atmosphere. It was once believed that the magnesian limestones were characterized by an extraordinary degree of durability, the work at Southwell Minster, built in the 11th century, being pointed to as illustrative of the fact. Truly enough, the magnesian limestone there employed had proved so durable that it bore even the marks of the masons' tool, against all the effects of a changing temperature, during eight hundred years. On this account magnesian limestone was chosen for the construction of the new Houses of Parliament. It was soon found, however, that the smoke of London had a powerfully decomposing effect upon it, because of the affinity which magnesia has for the sulphurous acid contained in such large quantities in the smoke of the metropolis. Stone suffers greatly by disintegration, the principal cause being the freezing of the minute particles of water which insinuate themselves into the pores and laminæ of stones. These particles of water swell slowly as crystals of ice are formed, and so burst open the pores or split the grain of the stone. The simplest and readiest mode of preserving stone is to paint it in oil-colours, and this expedient has indeed been adopted in the case of the stone frontage of Buckingham Palace. Nevertheless, the coating of stone with paint can never be regarded otherwise than as a poor method of escaping from a difficulty. The application of a soluble solution of silica applied after the manner of a varnish is, perhaps, the best preservative yet known. When this solution comes to be acted upon by the atmosphere, a chemical change takes place, the result being that silicic acid is left filling up the pores of the stone, thereby preventing the ingress of moisture or other disintegrating medium. Ransome's patent is a modification of this process, and consists in giving the already silicated stone a supplementary varnish of chloride of calcium. The external applications proposed (besides the soluble silica) for protecting the surface of stones are numerous. The most promising of these seem to be oily, fatty, resinous matters, which the stone is made to imbibe, sometimes by being boiled in them. Gutta-percha, quick-lime, copperas, and various other substances, have also been introduced into the preparations. Patents were taken out in 1856 for applications first of a solution of sulphate of zinc or of alum, followed by one of sulphur in oil; and another for a solution of wax in coal-tar, naphtha, &c.

STORAX. (*See* STYRAX.)

STORK, *stork'.*—A name given to certain large birds, of the genus *Ciconia*, family *Ciconiidæ*, but especially to the species *Ciconia alba*. It is about 3½ feet long, head neck and body of a white colour, wings partly black and bill and legs red. It often builds on the roofs of houses.

STORMS. (*See* WIND.)

STRABISMUS. (*See* SQUINTING.)

STRANGULATION, *strang-yu-lai'-shun.*—The act of killing by intercepting the breath. It is produced by forcibly compressing the anterior of the windpipe, or by drawing a rope tightly round the neck. (*See* HANGING.)

STRATUM, *strai'-tum*, (Lat., *struo*, I spread or lay).—A term used in Geology, and applied both to the separately deposited layers of rock and the rocks composed of these similar layers accumulated together. In special and local descriptions of rocks, the several beds are usually called *strata*. In geological classifications the following is the rank assigned to the different terms, according to size:—1. Systems: 2. formations; 3. strata; 4. beds; 5. laminæ.

STRAWBERRY. (*See* FRAGARIA.)

STRENGTH, ANIMAL. (*See* ANIMAL STRENGTH.)

STREPSIPTERA, *strep-sip'-te-ra* (Gr., *strepho*, I twist; *pteron*, a wing).—These insects were discovered by Kirby, living parasitic in the abdomen of some Andrenæ. At first nondescript, and not referable to any order, they were afterwards placed in an order by themselves. The larvæ live in the bodies of bees, wasps, &c. Only the males undergo perfect metamorphosis, the females, even when adult, being without legs, wings, or eyes, and continuing to live parasitic within the bodies of the hymenopterous insects within which they were born. About ten or twelve different species are known, forming a small family called *Stylopidæ*, of which the genus *Stylops* is the type.

STRONTIUM, *stron'-she-um.*—In Chemistry, the metal of which the alkaline earth strontia is the protoxide. It greatly resembles barium in its properties and combinations, but is not so abundant in nature. It occurs principally as carbonate (*strontianite*) and sulphate (*celestine*). It is a metal of a pale yellow colour, and is procured in the same way as barium. Heated in air, it burns with a yellowish flame, emitting sparks. Water is decomposed by it with evolution of hydrogen. It dissolves readily in dilute nitric acid, but the concentrated acid has no action upon it. It forms two oxides,—the protoxide, strontia, which is described below and the binoxide, which is deposited as a hydrate in crystalline scales, when a solution of binoxide of hydrogen is added to a solution of strontia. *Chloride of strontium* crystallizes in needles, which deliquesce in the air; hence the nitrate of strontia is used for pyrotechnic purposes. It dissolves in alcohol, and burns with a brilliant red flame. The sulphides are similar in properties and character to the corresponding sulphides of barium.

Strontia, *stron'-she-a.*—In Chemistry, SrO, an alkaline earth very similar in character to baryta. It receives its name from having been discovered in the mineral *strontianite* found at Strontian, in Scotland. It may be readily prepared from the native carbonate by dissolving it in nitric acid, and heating the resulting nitrate to redness in a crucible, until no more fumes are evolved. It is similar to the corresponding alkaline earth baryta in most of its properties. It combines with water with great energy to form hydrate of strontia. The *crystallized hydrate* has the formula SrOHO+9Aq. *Carbonate of strontia* constitutes the mineral known as *strontianite*. *Nitrate of strontia* is easily prepared by dissolving the carbonate in nitric acid, and crystallizing. The crystals are anhydrous octahedra, which decrepitate when heated. They are soluble in five parts of cold and considerably less of hot water. Nitrate of strontia is much employed in the preparation of "*red fire*" for the theatres. A good mixture for this purpose may be made of forty parts of nitrate of strontia, thirteen of flowers of sulphur, ten of chlorate of potash, and four of sulphide of antimony. *Sulphate of strontia* is found native as *celestine*, crystallized in rhomboidal prisms. It may be prepared artificially by a solution of nitrate of strontia with sulphuric acid.

STRUTHIONIDÆ, *struth-i-on'-idee.*—The name of a family of birds of the group *Ratitæ*, represented by the ostriches of Africa, Arabia, and South America, and the cassowaries and emus. (*See* OSTRICH, EMU, CASSOWARY.)

STRYCHNINE, *strik'-neen* (Gr.)—In Chemistry, one of the alkaloids found in the *Strychnos nux-vomica*, and the *Strychnos Ignatii*, or Ignatius's bean, in company with *brucine* and *igasurine*. In the former, strychnine and brucine are found in the form of lactates.

Method of Extraction.—The rasped seeds are boiled with four times their weight of alcohol acidulated with one per cent. of sulphuric acid. The alcoholic liquid is neutralized with milk of lime in slight excess; the acid and colouring matters being thus precipitated, the basis remaining in solution. The alcohol is distilled off, and the residue treated with acidulated water, from which the two alkaloids are afterwards precipitated by ammonia. They are then converted into nitrates and crystallized, the nitrate of strychnine crystallizing out first. Strychnine is one of the most powerful of the vegetable bases, precipitating many of the metallic oxides from their salts, and in many cases forming compounds with them, of which the double sulphate of strychnine and copper may be taken as an example. Strychnine crystallizes from dilute alcohol in anhydrous octahedra, or in square prisms, which do not fuse on the application of heat. It is insoluble in absolute alcohol, ether, and the caustic alkalies; but it dissolves in the essential oils and in chloroform. It dissolves in 7,000 parts of cold water, giving an intensely bitter solution, which is still retained even when diluted with 100 parts of water. With the acids it forms well-defined salts, which are mostly crystalline and soluble. In minute portions, from the twelfth to the sixth of a grain, it is used as a tonic in medicine, with a special action on the nerves of motion. In doses of two or three grains, it is a most powerful and fatal poison; it is therefore frequently used in cases of murder and suicide. Its principal action seems to be on the motory nerves, producing lockjaw and paralysis of the heart and lungs.

STRYCHNOS, *strik'-nos* (Gr.).—A genus of the natural order, *Loganiaceæ*, containing some of the most poisonous plants known. *S. nux-vomica*, the koochla-tree of India, produces nux-vomica seeds. These are imported into this country from Coromandel and Ceylon. They are extremely poisonous, from containing the alkaloids *strychnia*, or *strychnine*, and *brucine*. Three-quarters of a grain of the former alkaloid has been known to produce death; it is, however, a valuable stimulant of the nervous system, and has been frequently employed in paralysis. Nux-vomica seeds are largely used by gamekeepers and farmers to destroy vermin. The bark of the koochla-tree is also very poisonous. It was formerly confounded with cusparia or augustura bark; hence it is sometimes termed false augustura bark. An aqueous extract of the bark of *S. tienté* is the terrible Java poison called the *upas tienté*. The juice of *S. toxifera* is the basis of the celebrated *Wourali* or *Ourari* arrow-poison of Guiana. The wood of some Asiatic species is employed as an antidote to the bites of poisonous snakes, and on this account is generally called *lignum colubrinum*, or snake-wood. It has been used medicinally in intermittent fevers. The bark of *S. Pseudoquina*, which contains neither *strychnine* nor *brucine*, is extensively employed in Brazil as a substitude for cinchona bark. It is frequently erroneously called copalchi bark. The dried ripe seeds of *S. potatorum* are called clearing-nuts, from being employed by the Hindoos to clear muddy water.

STURGEON. (*See* STURIONIDÆ.)

STURIONIDÆ, *stu-re-o'-ne-de* (**Lat.** *sturio*, an icicle, because the snout tends to a point like an icicle).—A family of fishes belonging to Cuvier's division called *Chondropterygians*, or cartilaginous fishes, the skeletons of which are made up of cartilage instead of true bone.

Divisions.—Four genera are contained in this family, —*Accipenser*, *Spatularia*, *Chimæra*, and *Callorhynchus*. To the first of these belongs the common sturgeon. The general form of this fish resembles that of the shark; but it is distinguished by longitudinal rows of bony plates or bones implanted on the skin; the head is defended by similar plates; the mouth is small, and, as in sharks, placed below the snout; while the mouth is capable of some degree or projection, by its position on a style with three articulations. Instead of teeth, the mouth is furnished with a sort of horny process on the jaws. The lower jaw is furnished with a sort of beard of soft fibres. The eyes and nostrils are placed laterally and wide from each other. There is no vestige of an external ear, but the labyrinth is perfect within the bones of the head. The tail is forked, the upper lobe being much the longest and pointed. Sturgeons are mostly large, and inhabit the shores of the temperate latitudes rather than either the torrid or the cold. They are marine fishes, and at certain seasons ascend in vast numbers particular rivers, where they are the subject of extensive fisheries, particularly in the large rivers which disembogue themselves into the Black Sea and Caspian, and the rivers of France and Prussia; they abound also in the large rivers of North America, where the species appear to be peculiar to that continent. The common sturgeon (*Accipenser Sturio*) is generally about seven or eight feet in length. Its whole body is very gelatinous; and the air-bag, when freed from fat and oil, is the purest gelatine that it obtained in the animal kingdom, and forms the genuine isinglass of commerce. Its flesh is white and delicate, resembling veal. Its roe forms common caviare. When caught in the Thames, within the jurisdiction of the lord mayor, it is considered a royal fish, the term being intended to imply that it ought to be sent to the sovereign; and it is said that the sturgeon was exclusively reserved for the table of Henry I. of England.

STUPOR. (*See* COMA.)

STUTTERING. (*See* STAMMERING.)

STY, *sti* (Anglo-Saxon, *stigend*).—A small boil on the edge of the eyelid. It should be bathed with warm water, or a light wet poultice applied, and after the discharge of a little pus it usually gets better. If, however, there be a succession of sties, tonics, such as iron and quinine, should be given.

STYLIDACEÆ, *sti-li-dai'-se-e.*—In Botany, a natural order of *Dicotyledones*, sub-class *Corolli-floræ*, consisting of herbs or undershrubs found in the swamps of Australia. Their properties and uses are unknown.

STYRACACEÆ, *sti-ra-kai'-se-e.*—In Botany, the Storax family, a natural order of *Dicotyledones*, sub-class *Corollifloræ*. Trees or shrubs, with simple, alternate, exstipulate leaves and axillary flowers. Calyx inferior or superior, 4—5-parted, persistent. Corolla of 5—10 petals, either united at base or distinct. Stamens equal in number to the petals, or twice or thrice as many, more or less coherent at base; anthers 2-celled. Ovary superior or inferior; style simple. Fruit drupaceous and fleshy. Seeds usually one in each cell; embryo in abundant fleshy albumen, with a long radicle. There are 12 genera and about 120 species, which are sparingly distributed in warm and tropical regions. They are principally remarkable for yielding stimulant balsamic resins. (*See* STYRAX.)

STYRAX, *sti'-raks.*—In Botany, the typical genus of the natural order *Styracaceæ*. *S. Benzoin*, the benjamin-tree, yields the well-known concrete balsamic exudation commonly called gum-benjamin. (*See* BENZOIN.) *S. officinale*, a native of Greece, the Levant, and Asia Minor, was the source of the original and classical storax, which has in modern times wholly disappeared from commerce. The product now called liquid storax comes from a species of the genus *Liquidambar* (which *see*).

SUBERIC ACID, *su'-be-rik.*—In Chemistry, a fatty acid originally found amongst the products of the oxidation of cork by nitric acid; hence its name from *suber*, cork. It is contained in this substance in but small proportions, and is most readily obtained by the oxidation of the fats, more especially those of the stearic series. It forms a crystalline white powder destitute of odour, and having a slightly acid taste. It is soluble in 100 parts of cold and in 2 parts of boiling water. It is also soluble in alcohol and ether. Heated to 257° Fahr., it melts, and runs up the sides of the vessel in which it is treated. The suberates of the alkalies and earths are soluble and crystallizable, and form white precipitates with the salts of the metals.

SUBLIMATE, CORROSIVE. (*See* MERCURY, CHLORIDES OF.)

SUBLIMATION, *sub-lim-ay'-shun.*—A Chemical process of purification and separation, by which certain substances are heated to a state of vapour, which passing into a colder receptacle, crystallizes there, these crystals being quite pure.

SUBSTITUTION THEORY, *sub-ste-tu'-shun.*—In Chemistry, the formation of compounds by displacement of certain of their constituents by others possessing similar properties. The simplest example of substitution may be cited in the case of iron rusting in damp air, metallic iron gradually replacing the hydrogen of the water which is set free. Oxide of iron may therefore be regarded as a substitution compound of water, in which hydrogen is replaced by iron. In organic chemistry, substitution compounds are most numerous and interesting. They are mostly substances in which hydrogen is replaced by a metal, a halogen, a hydrocarbon, or even by a complicated group. They are generally formulated so as to show the original body from which they are formed; sometimes, however, for the sake of shortness, their empirical formula is given. Ammonia may be taken as a type of the infinite number of compounds of this kind that may be prepared. Ammonia may be represented as consisting of H_3N. Each of three H's may be replaced by a metal or a hydrocarbon; thus we have ethylia (*ethyl*) $C_4H_5H_2N$; diethylia (*ethyl*) C_4H_5 (*ethyl*) C_4H_5HN; triethylia, methylia, dimethylia, and so on almost *ad infinitum*. With the metals, we obtain potassamine K_1H_2N; trimercuramine Hg_3N, and so on; with the halogens and acid radicles we get I_2HN, diniodamide, and another almost infinite series. The process does not alone take place with the H's, but also with the N's, which can be replaced by phosphorus, antimony, and other bodies. The acids also form a large number of substitution compounds, of which chloracetic acid may be given as an example: Acetic acid, $HO,C_4H_3O_3$; Chloracetic acid, $HO,C_4Cl_3O_3$. Neutral bodies also produce substitution compounds, of which benzole may be taken as a specimen: Benzole, $C_{12}H_6$; Chloro-benzole, $C_{12}H_5Cl$; Nitro-benzole, $C_{12}H_5(NO_4)$. The discoverer of substitution organic compounds was Gay-Lussac, who, in endeavouring to bleach bees-wax with chlorine, found that certain of the equivalents of hydrogen contained in that body were replaced by the halogen, a compound being formed, which, when burnt, emitted hydrochloric acid. The study of substitution compounds has always been most attractive to organic chemists. The researches of Laurent, Gerhardt, Hoffmann, and others in this direction, have exerted a very important influence on chemistry, both as a theoretical and practical science. The whole series of coal-tar dyes, for instance, resulted entirely from the study of the substitution compounds of ammonia. In the hands of Berthelot and others, the theory has resulted in the synthetic formation of organic compounds, and the day does not appear to be far distant when numerous substances which are now obtained in minute quantities from plants and animals, will be formed from their ultimate elements in the laboratory.

SUCCINIC ACID, *suk-si'-nik*.—This acid, as its name imports, was originally obtained from amber (*succinum*) by destructive distillation. It may, however, be obtained by several other methods, perhaps most readily by diffusing crude malate of lime through warm water, a small quantity of decayed cheese being added as a ferment. The mixture is kept at a temperature of about 100° for a week, carbonic acid being disengaged, carbonate and succinate of lime crystallizing out, and acetate of lime remaining in solution. The succinate of lime is washed, decomposed with hydrochloric acid, and the succinic acid crystallized from the solution. Succinic acid crystallizes in large, regular, rhombic tables. It dissolves in 5 parts of cold and 2 parts of boiling water. Alcohol dissolves it readily, but ether only sparingly. At a temperature of about 347° to 356° it melts, and if suddenly heated to 455°, it melts, boils, and sublimes completely. It forms with the bases three sets of salts, most of which crystallize readily. The succinates are characterized by giving a bulky brown precipitate with the neutral salts of sesquioxide of iron.

SUCTORIA, *suk-to'-re-a*.—An order in Entomology, so designated on account of their sucking propensities. The genus *Pulex* of Linnæus constitutes the entire order. The mouth consists of a sucker of three parts, contained between two articulated blades, forming by their union a trunk or beak. The order is not numerous in species. The *Pulex irritans* is the common flea.

SUFFOCATION, *suf-fo-kai'-shun*.—The act of choking or producing death by the interruption of the breath. The three ordinary ways in which suffocation may be effected are hanging, drowning, and the respiration of fixed air, or carbonic acid gas. (*See* HANGING, DROWNING.) In suffocation by carbonic acid gas, whether arising from mines, lime-kilns, vats of fermenting liquor, &c., death takes place very rapidly. In every case of suffocation, our attempts at reanimation should be directed to renew respiration by inflation of the lungs; to restore the animal heat by exposure to warm pure air, and by assiduous frictions of the surface; to rouse by stimulation, and by brushing the soles of the feet and palms of the hands; and when necessary, to relieve cerebral congestion by moderate and cautious bleeding.

SUGAR, *shug'-ar*.—A name given to a variety of sweet principles found in plants and animals. All sweet tasting things, however, are not sugars, thus acetate of lead (formerly called sugar of lead), glycerine, &c., are not sugars though they have a sweet taste. Chemically speaking, there are four principal varieties of sugar:—1. Cane sugar; 2. Fruit sugar, or fructose; 3. Glucose, grape, or starch sugar; 4. Milk sugar. Although differing but slightly in chemical composition, these varieties of sugar possess very different sweetening powers, cane sugar being at the head of the list in this respect. The first three occur in the juices of plants, the fourth being exclusively found in the milk of animals; whence its name.

Cane sugar, or Sucrose.—This variety of sugar is, as its name implies, obtained principally from the sugar-cane. In Canada, however, the sugar-maple, and in many parts of Europe the beetroot, furnish the chief supplies. It also exists in carrots, turnips, pumpkins, chestnuts, and a large number of tropical fruits. Cane sugar has a specific gravity of 1·6; it is soluble in one-third of its weight of cold water, forming the thick liquid commonly known as syrup. It is also somewhat soluble in alcohol, which, however, requires to be heated before it takes up any quantity. By evaporating the aqueous solution, large four-sided rhomboidal prismatic crystals are formed, as seen in sugar-candy. Loaf sugar consists of a mass of small crystals; the more numerous the crystals, the more dazzlingly-brilliant is the sugar. When two pieces of sugar are rubbed together in the dark, a pale violet light is emitted. The chemical composition of cane sugar is $C_{12}H_{11}O_{11}$. If a solution of cane sugar be kept boiling for some time, it becomes less sweet, the elements of water being assimilated, and uncrystallizable fruit sugar, $C_{12}H_{12}O_{12}$, is formed. If the boiling be continued for some hours, two more equivalents of water are taken up, the fruit sugar becoming converted into grape sugar, $C_{12}H_{14}O_{14}$. To counteract this, a small quantity of lime is always added to the solution of cane-juice before it is boiled. Sugar forms an important article of food, entering largely into all vegetable aliments. Alone, it does not seem capable of supporting life, although, by preventing the waste of the tissues, it may be used as a temporary palliative of hunger. Mixed with nitrogenous matter, it appears to have a fattening tendency. It is a powerful antiseptic, as exemplified in its preservative action on meat and fruit. Solution of sugar has the peculiar property of dissolving many of the metallic oxides; lime, baryta, oxide oil ead, forming strong solutions when boiled with it. It exercises a powerfully reducing action on several of the metallic salts; the chromates, for instance, being reduced to sesquioxide of chromium when heated with a solution of sugar. Cane sugar, under the influence of yeast of beer, undergoes the process of fermentation (*see* FERMENTATION), becoming converted first into fruit sugar, and then into carbonic acid and alcohol. Treated with strong sulphuric acid, sugar parts with its water, carbonic and formic acids being eliminated, and a carbonaceous being left behind. Heated to 320° Fahr., sugar melts into an amorphous transparent solid, which, if kept, gradually loses its transparency and returns to the crystalline form. A solution of cane sugar exercises right-handed rotation on a ray of polarized light. Heated to about 420°, sugar loses two equivalents of water, becoming converted into a brown deliquescent and almost tasteless substance, much used by cooks and confectioners as a colouring matter, under the name of caramel. It differs from sugar in not being susceptible of fermentation. If the heat be carried further, inflammable gases are emitted, a friable mass of pure charcoal being left behind. Caramel appears to be a definite compound, uniting with baryta and basic acetate of lead. It is soluble in water, and is separable from its solution as a brown powder by alcohol.

Manufacture of Cane Sugar.—The chief source of sugar in this country, in the state in which it is offered for sale, is the sugar-cane. The plant, of which there are several varieties, is a solid-jointed reed, growing to a height of from six to fifteen feet. It flourishes best in the tropics, although it has been grown in the warmer parts of the temperate zones. The canes are cut down to the roots just before the period of inflorescence, stripped of their leaves, and submitted to powerful pressure between grooved iron cylinders. The juice which if left to itself would ferment, is immediately mixed with $\frac{1}{800}$ of its weight of lime, and heated to 140° in large copper or iron pans. By this means the albuminous parts of the juice rise in scum to the top, and any free acid is neutralized by the lime, which also prevents the transformation of the cane sugar into grape or starch sugar. After being allowed to cool, the clear juice is drawn off for concentration by boiling. When the syrup has reached a sufficient consistence, it is run into shallow coolers, and allowed to rest for twenty-four hours. It is then briskly stirred to favour crystallization, and transferred to casks with perforated bottoms, which allow the molasses, or the liquid uncrystallizable portion of the syrup, to drain off. The crystals are dried in the sun, and form the raw brown sugar of commerce.

Maple Sugar is obtained by the American Indians from a species of maple, the *Acer saccharinum*, by making perforations into the wood of the tree when the sap is rising. This source of sugar is unfortunately unavailable, from a peculiar and disagreeable flavour remaining in the manufactured article, no matter how far the refining process has been carried. Were it not so, Canada could easily grow sufficient sugar to supply half the world. The experiments of certain chemists, however, seem to indicate that the objection may, to a certain extent, be overcome.

Beetroot Sugar is manufactured in large quantities in France, Prussia, and Austria. The manufacture of beetroot sugar was called into existence in the former country by the wars of Napoleon, which cut off the ordinary colonial supplies of cane sugar. The roots employed are those of the white beet, and are gathered in October. The fresh expressed juice contains theoretically 10 per cent. of crystallizable sugar; not more, however, than from five to seven per cent. is extracted in practice. The juice is mixed with a small quantity of lime, and boiled; the albuminized constituents rise to the top as a scum, which is carefully removed. The clear syrup is then filtered through animal charcoal, which, in fact, extracts the colour from it; it is again concentrated, and filtered a second time through the charcoal and coarse cloth bags; after which it is evaporated to crystallizing-point. The crystals of beetroot sugar are somewhat longer than those of cane sugar, but in no other respect is there any difference between the two substances. Visitors to the continent always find that it takes apparently more beetroot sugar to produce a given amount of sweetness than the ordinary cane sugar used in England. The reason of this is not that the sweetening power of beetroot sugar is small, but that the French sugar-refiners employ a peculiar method of crystallization, by which the crystals of sugar are very loosely aggregated together, giving the appearance of intense whiteness and great bulk.

Refining of Sugar.—Both cane and beetroot sugar are refined on the same principle, by mixture with lime-water, boiling with animal charcoal, and filtration through twilled cotton. In some establishments, bullock's blood is used to aid in the clarifying. The albumen of the serum becomes coagulated on the application of heat, forming a network, which rises to the top of the liquor, carrying with it a great part of the impurities. The reddish syrup obtained by the first filtration is next passed through filters into large vats, twelve or fourteen feet deep, upon which are laid coarse ticking, coarsely-ground animal charcoal, and a second layer of ticking. The syrup is allowed to flow over the surface of the filter, and runs slowly through the charcoal, coming out perfectly colourless. The concentrated syrup in then boiled *in vacuo*; by which means two important results are arrived at. The viscid liquid would boil in air at 230° Fahr., at which temperature a quantity of uncrystallizable sugar would be formed. By performing the operation in a vacuum-pan, the boiling-point is brought down to 150° or 160°, no formation of uncrystallizable sugar taking place, and a great saving in fuel being effected. When the concentration reaches a certain point, the syrup is transferred to a vessel heated by steam to 170°, and forcibly agitated with wooden beaters, until it becomes thick and granular. From the heating-vats it is transferred into inverted conical moulds of the well-known shape, at the bottom of each of which is a movable plug. The syrup is well stirred to prevent the formation of air-bubbles, and then left at rest for several hours, at the end of which time the plug is removed, and the uncrystallized syrup runs out. The loaves are further freed from all coloured matter by a portion of perfectly colourless syrup being run through them. They are then dried in a stove, and finished for market by being turned in a lathe.

Crushed or Crystallized Sugar is made by causing the granular syrup to revolve in a perforated drum, by which means the uncrystallizable portion is separated from the crystals by centrifugal force.

Fruit Sugar, or Fructose exists ready formed in ripe acidulous fruits and honey, which owe their sweetness to its presence. It may be made artificially from starch and woody fibre by the action of dilute sulphuric acid, continual boiling transforming it into grape sugar. Fruit sugar does not crystallize. It often assumes the elements of water when fruits are dried, giving rise to the formation of crystalline grape sugar.

Grape Sugar, Starch Sugar, or Glucose.—Grape sugar exists ready formed in the grape, and in many fruits and vegetables. It may be made artifically from starch by allowing a mixture of that substance, with a sufficient quantity of water to render it liquid, to flow gradually into a vat containing water acidulated with one per cent. of sulphuric acid, which is kept continually at boiling-point. After the whole of the starch liquor has been added, it is kept boiling for half an hour, by which time the whole of the starch has become converted into sugar. The liquid is then neutralized with chalk, concentrated by evaporation, drawn off carefully, and set aside to crystallize. Grape sugar may be made from ligneous fibre by the same means, substituting a stronger solution of sulphuric acid than the one above mentioned. It is said by Bernard to be a normal constituent of the liver. It is also met with as a morbid constituent of the urine in diabetes. It may be readily distinguished from cane sugar by being considerably less soluble in water. Its sweetening power is only $\frac{3}{5}$ths of that possessed by cane sugar. It crystallizes in hard warty concretionary masses, which consist of hard transparent cubes. It forms a crystalline compound with common salt, the corresponding cane sugar compound being non-crystalline and deliquescent. Sulphuric acid transforms it into sulpho-saccharic acid. It forms definite but unstable compounds with the alkalies, which decompose, giving rise to a peculiar uncrystallizable acid,—glucic acid, which remains in combination with the base. The chemical composition of glucose is $C_{12}H_{14}O_{14}$, while starch is $C_{12}H_{10}O_{10}$.

Sugar of Milk, or Lactose.—This sugar is obtained solely from the milk of the mammalia. The milk is coagulated, and the curd separated. The whey is concentrated by evaporation, and small sticks of wood are inserted in the liquid, around which the sugar crystallizes in mammillary masses, consisting of four-sided prisms, terminated by four-sided pyramids. It possesses the least sweetening power of any of the sugars. By continued boiling with dilute acids, it may be converted into fruit sugar. When pure, it does not ferment under the action of the yeast, although milk may be fermented and made to yield a spiritous liquor. Lactose unites with several of the bases in a similar manner to its congeners. The chemical composition of milk sugar (lactose) is $C_{24}H_{24}O_{24}$.

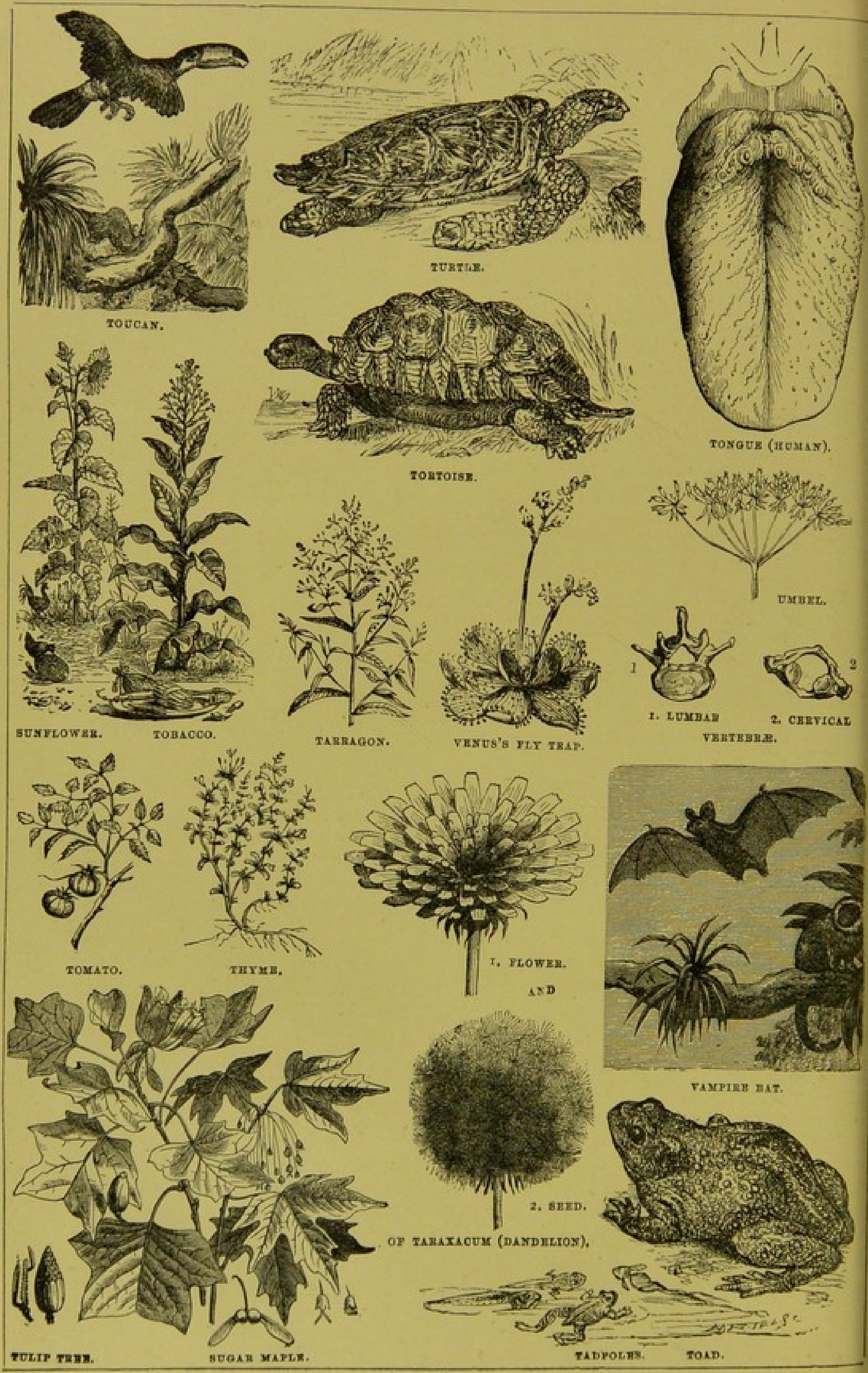
Sugar, Statistics of.—Respecting the progressive consumption of sugar in Great Britain, we find it stated in MacCulloch's "Dictionary of Commerce" that sugar was certainly sent to England by the Venetians and Genoese in the 14th and 15th centuries. There is an account of a shipment made at Venice for England in 1319 of 100,000 lbs. of sugar and 10,000 lbs. of sugar-candy. This sugar is said to have been brought from the Levant. At that period, however, honey was the principal ingredient employed in sweetening dishes and liquors. Even in the early part of the 17th century, the quantity of sugar imported was very inconsiderable; and it was made use of only in the houses of the rich and great. It was not until the latter part of the century, when coffee and tea began to be introduced, that sugar came into general demand. In 1700, the quantity consumed in Great Britain was about 10,000 tons; whereas, in 1867, the consumption amounted to above 584,866 tons, or more than 1,310,000,000 lbs.; so that sugar now forms an important necessary of life. By the Customs and Inland Revenue Act of 1870, the duties on sugar were much reduced; while in May, 1873, they were still further reduced, and on 1st May, 1874, abolished altogether. The amount of raw sugar imported into Great Britain in 1879 was 17,734,223 cwts.

SUIDÆ.—The Hog family (which *see*).

SULPHATES. (*See* SULPHURIC ACID.)

SULPHIDES, *sul'-fydz*. (*See* SULPHUR.)

SULPHION, *sul'-fe-on*.—A hypothetical radicle, supposed, according to the binary theory of salts, to be the base of sulphuric acid, which is regarded as its hydride, HSO_4. Sulphion would thus fall into the same category as chlorine and bromine, sulphuric acid being its hydride, as hydrochloric acid is the hydride of chlorine, the


TOUCAN.
TURTLE.
TONGUE (HUMAN).
TORTOISE.
UMBEL.
SUNFLOWER.
TOBACCO.
TARRAGON.
VENUS'S FLY TRAP.
1
2
1. LUMBAR
2. CERVICAL
VERTEBRÆ.
TOMATO.
THYME.
1. FLOWER.
AND
2. SEED.
OF TARAXACUM (DANDELION).
VAMPIRE BAT.
TULIP TREE.
SUGAR MAPLE.
TADPOLES.
TOAD.

sodium of salts being $NaSO_4$ and NaCl the sulphionide and chloride of sodium. The name sulphionide of sodium, as proposed for sulphide of soda, has not as yet come into use, although the followers of the binary theory mark the change of view by using the terms sulphate of sodium, calcium, magnesium, &c. These remarks equally apply to the other oxy-acids.

SULPHITES. (*See* SULPHUROUS ACID.)

SULPHO-SALTS, *sul'-fo-saults.*—Salts in which the oxygen appears to be replaced by sulphur, both in the base and the acid, as in sulphantimoniate of soda,—$3NaS,SbS_5+18aq.$

SULPHUR, *sul'-fur* (Fr., *soufre*, Du., *solfer*) —symbol S; equiv. 16.—Sulphur, or brimstone, has been known and used from the earliest times. It is found native in mechanical combination with various earthy impurities in most volcanic districts, more particularly in Sicily and the countries bordering on the Mediterranean. The Sicilian sulphur, which is largely imported into England, occurs in beds of a blue clayey formation. It is found native in two forms,—in transparent amber crystals, as virgin sulphur, or in opaque, lemon-yellow crystalline masses, as volcanic sulphur. It is found in combination with the different metals, forming metallic sulphides, in nearly every portion of the earth. Zinc blende, iron and copper pyrites, galena, cinnabar, gray antimony, and realgar, are a few instances of the valuable ores containing sulphur. In its oxidized condition as sulphuric acid, it is also very largely distributed over the mineral kingdom. Sulphur also exists in many organic bodies; for example, it is always contained in albumen and the various protein compounds. The sulphur of commerce in this country is now obtained principally from iron and copper pyrites, of which large mines exist in the north of England, in Ireland, and in Spain. Native sulphur is purified from the foreign substances mixed with it by distillation in, first, long brick furnaces containing earthen retorts communicating with receivers of the same material, and afterwards, in iron retorts communicating with chambers of brickwork, in which the sulphur condenses in light flocks, known as flowers of sulphur. When melted and cast, these form the roll brimstone of commerce. Sulphur is made from pyrites by roasting this mineral and condensing the sulphur volatilized by the heat.

Sulphides.—The combinations of the metals with sulphur are hardly less important, both in a chemical and economical point of view, than the oxides. A large number of these occur in nature, having a high metallic lustre, and forming valuable ores. Sulphur generally combines with the metals in varying proportions, and it generally happens that the number of oxides and sulphides of a given metal are equal. Exceptions to this, however, occur in the case of the alkalies and alkaline earths: thus there are but two oxides of potassium, sodium, and barium, whilst there are no less than five sulphides of these metals. All the metallic sulphides are solid at ordinary temperatures; most of them fuse at a red heat, and some sublime unchanged. If air be admitted to the heated sulphides, they are all decomposed, the sulphur becoming oxidized, and either passes off, leaving the oxide of the metal behind, or unites with the base forming the sulphate, which, if the heat be continued, decomposes in certain cases, leaving the oxide behind. The sulphides of the noble metals part with the whole of their sulphur, the pure metal remaining. The sulphides are all insoluble in water, with the exception of those of potassium, sodium, strontium, barium, and calcium. Sulphide of magnesium is only slightly soluble. Sulphides are prepared in a number of ways:—By heating the metal or its oxide with sulphur; by decomposing the sulphates; by heating them with charcoal or in a current of hydrogen; by passing a stream of sulphuretted hydrogen through their solutions, or by adding to them a solution of an alkaline sulphide. (The preparation of particular sulphides will be found described under the heads of their bases.) Certain of the higher sulphides, as for instance the pentasulphides of arsenic and antimony, act as acids, forming soluble and crystallizable salts with the alkaline protosulphides. The sulpharseniate and sulphantimoniate of sodium are examples of this.

Properties of Sulphur.—At ordinary temperatures, sulphur is a brittle, insoluble, inodorous solid, of a lemon-yellow colour, a bad conductor of heat, and a non-conductor of electricity. By friction with silk or wool, it becomes negatively electrified. It is a highly inflammable substance, burning readily in the air at about 450° or 500° Fahr., and giving off suffocating fumes of sulphurous acid gas. At 239° Fahr. it melts, forming a yellow liquid, and slightly increasing in bulk. Provided the above temperature is not exceeded, it remains nearly transparent on cooling, but becomes gradually opaque from interior molecular changes. In close vessels, it may be distilled by raising the heat to about 834° Fahr. Sulphur is very remarkable as affording a striking instance of the occurrence of the allotropic condition of matter. The first form is that of native sulphur in the crystalline state. It may be obtained artificially by evaporating a solution of sulphur in bisulphide of carbon. It is semi-transparent, of an amber-yellow colour, and has a density of 2·05. Its crystals undergo no change in the air, and it fuses at 239° Fahr. It is distinguished from the other forms as $S\alpha$. The second variety, $S\beta$, is obtained by melting ordinary sulphur in a ladle, and allowing the surface to solidify. The solid crust is then pierced and the melted sulphur beneath is run out. The underneath portion of the solid crust is found to be covered with transparent brownish-yellow needles, having a specific gravity of only 1·98. Sir B. C. Brodie states that it melts at 248° Fahr. In a few days the transparency of the crystals disappears, and an opaque crumbling mass is formed. The third variety, $S\gamma$, is even more remarkable. Ordinary sulphur is melted, the heat being increased till it reaches 350°, when it becomes viscid and brown. The temperature is still further raised until 500° Fahr. is attained, when it gradually returns to a fluid condition. If now suddenly poured into cold water, a tenacious mass is produced, which may be drawn out into elastic threads. Magnus states that this condition is due to the formation of a certain amount of another modification, which he calls black sulphur. $S\gamma$ gradually returns to the form $S\alpha$ if left to itself. $S\alpha$ and $S\beta$ both dissolve readily in bisulphide of carbon, but $S\gamma$ is insoluble in this liquid. The black sulphur of Magnus is also insoluble in bisulphide of carbon. Magnus has also succeeded in forming a red variety by heating the black modification to 320° or 330° Fahr. A blue modification has also been formed when solutions of hydrosulphuric and perchloride of iron are mixed together. Sulphur dissolves readily in bisulphide of carbon and dichloride of sulphur. Boiling oil of turpentine also dissolves it freely, depositing it again as it cools, but retaining 1½ per cent. Vitreous sulphur and the black modification of Magnus sulphur may be made to combine directly with most of the elements. Hydrogen and sulphur vapour, when burnt, form sulphuretted hydrogen. Burnt in oxygen, heated with chlorine, bromine, and iodine, it unites with them, forming well-known compounds. The vapour of sulphur passed over red-hot charcoal forms bisulphide of carbon. Nearly all the metals combine with it at ordinary or increased temperatures. With oxygen, sulphur forms seven different compounds:—Sulphurous acid, SO_2; Sulphuric acid, SO_3; Dithionous or hyposulphurous Acid, S_2O_2; Dithionic or hyposulphuric acid, S_2O_5; Trithionic acid, S_3O_5; Tetrathionic acid, S_4O_5; Pentathionic acid, S_5O_5. Sulphur unites with chlorine in two proportions, forming a dichloride and a chloride. The dichloride, S_2Cl, is prepared by transmitting a current of chlorine over melted sulphur, the resulting dichloride being collected in a perfectly dry receiver. It is a dark yellow liquid, very volatile, and possesses a peculiar, penetrating, disagreeable odour. It emits fumes when exposed to moist air, and when dropped into water gradually decomposes into hydrochloric and sulphurous acids and free sulphur. It has a specific gravity of 1·658, and boils at 280° Fahr. It is used for vulcanizing india-rubber goods. By saturating dichloride of sulphur with chlorine, a dark red liquid chloride is formed. There is reason to suppose that a bichloride exists, but it has not yet been isolated. The corresponding bromides are liquids analogous to the chlorides. The iodide is a crystalline brittle gray solid. With nitrogen, sulphur forms a bisulphide, which crystallizes in beautiful golden-yellow rhombic crystals. It detonates powerfully by percussion, or when heated to 314° Fahr. Bisulphide of carbon dissolves it readily, alcohol, ether, and oil of turpentine sparingly, and water not at all.

Sulphuretted Hydrogen, *sul-fu-ret'-ted.*—The familiar term for hydrosulphuric acid, under which head its properties are described.

Sulphurets, *sul-fu-rets'.*—These compounds are now generally known as sulphides, that word being more in unison with the corresponding chlorides, iodides, cyanides, &c.

Sulphuric Acid, *sul-fu'-rik.*—In Chemistry and Manufactory, oil of vitriol, vitriol, SO_3. This important acid occurs in nature in large quantities, both in the vegetable and mineral kingdoms, in combination with the various bases, more particularly the alkalies, alkaline earths, and the oxides of iron, copper, lead, zinc, alumina, &c. Its mineral combinations are generally known as vitriols, a name which, in the case of the sulphates of iron, copper, and zinc, has been transferred to the manufactured products. Sulphuric acid, SO_3, is formed by the oxidation of sulphurous acid, or some other oxide of sulphur. In its perfectly anhydrous condition, it occurs as a white crystalline fibrous mass, somewhat resembling asbestos in appearance. It can be mou ded in the fingers like wax without charring the skin; it fumes in the air, and is very deliquescent, hissing violently when thrown into water; thereby becoming sulphuric acid. It chars wood, paper, sugar, and other similar substances, by abstracting water from them. It melts at 65° Fahr., and boils at 110° Fahr., forming a colourless vapour. It possesses no acid properties whatever, and is not regarded as such by the followers of Gerhardt, by whom it is called sulphuric anhydride. The vapour, when passed through a red-hot tube, is resolved into a mixture of one volume of oxygen with two volumes of sulphurous acid. With sulphur it forms several more or less definite compounds, of a brown, green, and blue colour respectively, which have not as yet received sufficient investigation.

Preparation of Sulphuric Acid.—It may be prepared in several ways:—1. By distilling Nordhausen sulphuric acid at a gentle heat in a retort to the neck of which is fitted very perfectly a receiver surrounded with ice; 2. by heating sulphuric acid with anhydrous phosphoric acid. There are two varieties of sulphuric acid in commerce. The first of these, "fuming, or Nordhausen sulphuric acid," is obtained by the distillation of the basic sulphate of iron formed by heating crystals of common green vitriol. It is a somewhat viscid liquid, generally of a light brown colour, from containing traces of organic matter, and has a specific gravity of 1·896. It is believed to be a combination of equal parts of the anhydrous and monohydrated sulphuric acid, and may be represented by the formula $2SO_3HO$. It solidifies at 32° Fahr. into a mass of transparent colourless crystals. It is chiefly used in the arts for dissolving indigo. The second variety is the ordinary English sulphuric acid, or oil of vitriol of commerce. It is prepared in enormous quantities in this country, to the extent of 100,000 tons per annum, by burning sulphur or roasting pyrites, and oxidizing the resulting sulphurous acid by means of aqueous vapour and certain oxides of nitrogen, a process differing but little from that devised by Dr. Roebuck in 1720, although it has of course undergone various improvements and modifications since that time. The process depends upon the property possessed by peroxide of nitrogen of yielding up sufficient oxygen to sulphurous acid in the presence of atmospheric air and aqueous vapour to convert it into sulphuric acid. The binoxide of nitrogen resulting from the decomposition speedily absorbs oxygen from the air, which it again yields up to a fresh portion of sulphurous acid, the nitrogen compound acting as a vehicle for the convection of oxygen without being decomposed. Four substances are consequently required in the manufacture: 1. Sulphurous acid, obtained by burning sulphur in a furnace; 2. nitric acid vapour, procured by the action of sulphuric acid on nitrate of soda; 3. aqueous vapour, or steam; 4. atmospheric air. These are admitted from their sources by properly constructed flues into a large chamber, the bottom of which is lined with lead, and which contains water to the depth of three or four inches. The upper part of the chamber generally contains a number of incomplete leaden partitions, in order that intimate mixture may take place between the vapours. The water on the floor of the chamber continues to absorb the sulphuric acid formed, until it reaches a specific gravity of about 1·5, when it is drawn off and replaced by a fresh supply. Theoretically, nothing should pass from the exit-flues of the chamber but nitrogen and binoxide of nitrogen; but in practice a certain amount of sulphuric acid vapour always escapes. The mixed gases coming from the flue are therefore generally conveyed into subsidiary chambers supplied with steam, or through towers filled with coke, through which water is constantly falling. A weak acid is thus formed, which is used instead of water for the large chamber. Gay-Lussac devised a plan for saving the nitric oxide escaping from the flues, by taking advantage of the property possessed by the concentrated acid of absorbing this gas. The waste vapours are passed through coke towers through which sulphuric acid is falling, which completely absorbs the nitric oxide gas. The charged acid is then pumped into a second tower, when it yields up its nitric oxide to a stream of sulphurous acid. Gay-Lussac's process is but little used in this country. The acid withdrawn from the leaden chambers is concentrated by evaporation in leaden pans, until it reaches a specific gravity of 1·7. This acid contains a trace of organic matter, and is known in commerce as "brown," or "pan acid." Its further concentration is effected in glass or platinum retorts, until its specific gravity is 1·842. This is the ordinary strong oil of vitriol of commerce, and contains an equivalent of anhydrous sulphuric acid, united to an equivalent of water, SO_3HO. When pure, it is a heavy, oily, colourless, inodorous liquid, and having a specific gravity of 1·842. It is intensely caustic, and chars almost all organic substances, by abstracting water from them. Its affinity for water is very great, doubling its weight by the absorption of vapour from the air, if left exposed in any open vessel for several days. It mixes with water in all proportions. It freezes at −29° Fahr., and boils at 590° Fahr., its vapour being colourless and very suffocating, forming dense fumes in moist air. When mixed with water, it evolves considerable heat. Sulphuric acid is the starting-point of nearly every important chemical manufacture. Acetic, nitric, and hydrochloric acids are made by its means; and it will be only necessary to allude to the important part it plays in the manufacture of soda from common salt, to appreciate the saying of Leibeg, "that the amount of sulphuric acid made in a country is a sure index of its wealth and prosperity."

Uses of Sulphuric Acid.—In its concentrated form it is in daily use by the scientific chemist to promote the crystallization of deliquescent substances in vacuo, from its intense avidity for water. Besides the monohydrate above described, sulphuric acid forms several other well-marked hydrates; amongst which may be noticed the bihydrate, a colourless liquid, having a specific gravity of 1·78, and solidifying in transparent colourless prisms at about 40° Fahr., hence it is often called glacial sulphuric acid. It may be easily formed by mixing the monohydrate with water, until the proper specific gravity is reached. If a very dilute acid be evaporated in vacuo until it ceases to lose weight, a definite terhydrate is formed, having a density of 1·632. The oil of vitriol of commerce is never pure, but contains lead, derived from the leaden chambers in which it is made, arsenic, and nitric acid. The first impurity is detected on dilution, sulphate of lead (which is less soluble in dilute than in strong acid) falling down as a milky precipitate. Arsenic gives a yellow precipitate with sulphuretted hydrogen, and nitric acid a purplish-red coloration when a solution of green vitriol is added to the suspected acid. In its concentrated form, it acts but feebly on metallic bodies. When water is present, the more easily oxidizable metals are dissolved with the evolution of hydrogen.

Sulphates are the salts of sulphuric acid, and are amongst the most important chemical agents in the laboratory. They are numerous and important, and are mostly composed of an equivalent of acid and an equivalent of the metallic oxide. They vary somewhat in the numbers of atoms of water of crystallization, some being anhydrous, others containing as much as twelve equivalents. Sulphuric acid also forms acid bisalts, of which the bisulphate of potash may be taken as an example, $KO.HO.2SO_3$. In a few instances, basic salts are formed; as, for instance, the basic sulphate of copper, $3CuOSO_3$. Sulphuric acid and its salts are easily recognized by giving a white precipitate with a soluble salt of barium, insoluble in nitric acid.

Sulphurous Acid.—In Chemistry, SO_2, an acid formed by the union of an equivalent of sulphur with two of oxygen in a variety of ways, the most familiar being its production during the combustion of sulphur in the open air or in oxygen. The gas produced is endowed with the properties of a weak acid, and is the sole product of the combustion, provided the air or oxygen be perfectly dry. It has a pungent, suffocating odour, and when in a concentrated form, cannot be breathed with impunity. It is not inflammable, and extinguishes burning bodies. It dissolves freely in water, which takes up between forty and fifty times its bulk of the gas. The solution has the smell and taste of the gas itself, and becomes gradually converted into sulphuric acid, from absorbing oxygen from the air. Crystalline hydrate, SO_29HO and SO_2HO, may be obtained at a low temperature; the former melts at 40° F. Sulphurous acid gas is much used for bleaching straw and wool, the articles being moistened and suspended in a chamber in which sulphur is burning. It appears to act by forming a colourless compound with the colouring matter; for woollen goods which have been thus bleached become yellow on being washed with an alkaline soap. It is also used for preserving certain animal substances, such as vellum and catgut. It has also been employed as a disinfecting agent. At ordinary temperatures, sulphurous acid is a gas; but it may be readily condensed into a liquid by a pressure of three atmospheres, or by a freezing mixture of ice and salt. When the liquid acid is evaporated under the air-pump, part of it solidifies from the cold produced. The liquid acid boils at 14° F., and if poured into water, the cold produced by its reconversion into the gaseous state is so intense that the water is frozen. When required perfectly pure for laboratory purposes, sulphurous acid is made by the deoxidation of sulphuric acid. The mode generally adopted is to boil sulphuric acid with metallic copper or mercury, an equivalent of oxygen, leaving one portion of the acid to form an oxide with the metal. Sulphurous acid is a powerful reducing agent, liberating iodine from iodic acid, and precipitating tellurium and selenium from their acids.

Sulphites are somewhat weak salts, presenting considerable analogy to the carbonates, the salts of the same metals being often isomorphous. They are readily formed by passing sulphurous acid gas through water in which the carbonate or oxide of the metal is dissolved or suspended. They are decomposed by nearly all the acids, with the exception of the carbonic and boric, with the liberation of sulphurous acid. The acid sulphites of baryta, strontia, lime, and magnesia, and the neutral and acid sulphates of the alkalies, are soluble in water. Most of the others are insoluble, and may be precipitated by the addition of a soluble sulphate to their solutions. With the alkalies it forms a double set of salts, containing respectively one and two equivalents of acids. Bisulphite of soda was formerly much used as an antichlore, and bisulphite of lime is extensively employed in the manufacture of sugar.

SUMACH. (*See* RHUS.)

SUMBUL. (*See* NARD AND NARDOSTACHYS.)

SUN, *sun* (Sax., *sunna*).—Is the great central body of the solar system, and the grand source of light and heat. It has an apparent motion among the stars from west to east, along a great circle, called the ecliptic, making a complete circuit of the heavens in 365 days, 6 hours and 9 minutes, though the period from midsummer to midsummer is some twenty minutes less, owing to the precession of the equinoxes. (*See* PRECESSION OF THE EQUINOXES.)

The distance of the Sun from the Earth, &c.—Until quite recently, it was the belief of astronomers that the distance of the earth from the sun was in round numbers ninety-five millions of miles; but the researches of M. Leverrier and of Mr. Hind have corrected this view, their statement being that the actual distance of the heat and light-giving luminary is about 91,328,600 miles. It is by finding the solar parallax that the distance of the sun from us is formed. This parallax has not been exactly ascertained; and as a difference of 0·01" means over 100,000 miles of distance, it is quite clear that exactness seems almost impossible. The distance has lately been held to be about 92,000,000 miles. The calculations as to its diameter depends upon our calculation as to its distance. Taking this to be 91,328,600 miles, its diameter is 850,100 miles upwards of 107 times the mean diameter of the earth. The circumference of the sun is 2,671,000 miles; its solid contents or bulk exceeds that of the earth 1,405,000 times; that is to say, it would require that number of earths to make one globe of the magnitude of the sun. Its mass exceeds that of the earth 356,000 times. The sun rotates upon its axis in the same direction as the earth,—from west to east, in about 25 days 8 hours. By way of assisting the mind to comprehend the vast disparity there is in size between the sun and earth, as well as of its vast distance from us, a familiar illustration may be useful. A railway-train continuously maintaining a speed of thirty miles an hour would arrive at the moon in eleven months, but would take 352 years to reach the sun; so that to reach the sun in 1884, the train must have been started in 1532, the twenty-third year of Henry VIII.'s reign. Supposing the train to have reached the edge of the sun, and the vast luminary to have been tunnelled through, the train would take three years and a quarter in passing through, and it would take ten years and one-eighth in passing round it. The same train would pass through the earth in eleven days, and circumscribe it in thirty-seven days.

Shape of the Sun.—The observations of Littrow and Maskelyne make the shape of the sun a prolate spheroid; the researches of Carlini and Bianchi, on the other hand, make it an oblate spheroid, with a greater equatorial than polar diameter, like the earth. These different views being both doubted by other equally competent astronomers, it was proposed to prepare an apparatus for the purpose of examining the form or figure of the sun's disc; but the astronomer royal has observed, in effect, that what we know of the sun's diameter must lead us to the conclusion that the sun is a perfect sphere. If such be the truth, we have in the great centre of our solar system the only example of a perfect sphere; though it may be assumed as a possibility that the stars, the far-off suns of other systems, are like the sun in this respect.

Theories to account for the heat of the Sun.—Many theories have been put forth to account for the supply of the prodigious amount of heat constantly radiated from the solar surface. One theory is that the sun is now giving off the heat imparted to it at its creation, and that it is gradually cooling down; another ascribes it to combustion; a third to currents of electricity; a fourth to the compression of matter from the nebular state, the condensation going on continually, without altering the weight of the body. Newton and Buffon conjectured that comets might be the aliment of the sun, and at the present time, a nearly similar theory finds favour: viz., that a stream of meteoric matter, constantly pouring into the sun from regions of space near it, evolves its heat.

Physical Constitution of the Sun.—According to the best received hypotheses of the physical constitution of the sun, it is a "mass" of white hot vapour, and is thus enabled to shine by its own light. This "mass" would seem to be divided into strata, the first being a dense bed of vaporous clouds. Above this floats a luminous photosphere, composed of unconnected phosphoric clouds, and subject to continual fluctuations both from local causes of agitation and from the subjacent vapour acting by its elasticity to burst through the photosphere above it. Above all is a third envelope of perfect transparency and great depth, containing, in a vaporous condition, iron, sodium, lithium, and other metals. With regard to the constitution of the sun, Mr. Nelsen writes—"With the aid therefore of the additional information given up by the spectroscope, it is not very difficult to form a true idea of the probable condition of the surface of the sun which is all that we can see. It is the upper-lying strata of a very dense atmosphere of very high temperature—an atmosphere agitated by storms, whirlwinds and cyclones of all kinds, traversed by innumerable currents, and now and then broken by violent explosions. Above the brilliant surface which we see is a less dense and somewhat cooler upper stratum, which, though hot enough to shine quite brightly, is quite invisible in the presence of the brighter strata beneath it." Further, we believe the sun to be composed of materials similar to those of which the earth is composed, and what it would be if it were as hot as the sun is. Thus we can argue by analogy that as the sun and star-light gives us similar *spectra* to the *spectra* of earthly elements, the heavenly bodies are composed of the same elements as the earth.

Solar Spectroscopy.—Recent experiments with the spectrum indicate the presence in the sun's atmosphere of familiar elements. Frauenhofer discovered in the solar spectrum a series of dark lines which are hence known as "Frauenhofer's lines." Recently Kirchoff, by spectrum analysis, discovered in the atmosphere of the sun several metals, including sodium, calcium, lithium, iron, &c., and, says Professor Adams, "If we imagine the masses of iron, nickel, and magnesium in the sun to retain even a slight degree of magnetic power in their gaseous state—and we know, from the researches of Faraday, that gases are some of them magnetic—we have a sufficient cause for all our terrestrial magnetic changes; for we know that these masses of metal are ever boiling up from the lower and hotter level's of the sun's atmosphere to the cooler upper regions, where they must again form clouds to throw out their light and heat, and to absorb the light and heat coming from the hotter lower regions; then they become condensed and are drawn again back towards the body of the sun, so forming those remarkable dark spaces or sun-spots by their downrush towards the lower levels. In these vast changes, which we know from the science of energy must be taking place, but of the vastness of which we can have no conception, we have abundant cause for these magnetic changes which we observe at the same instant at distant points on the surface of the earth. The same cause, acting by induction on the magnetic matter within and on the earth, may well produce changes in the magnitude or in the direction of its total magnetic force. Thus both directly and indirectly, we may find in the sun, not only the cause of diurnal magnetic variations, but also the cause of these remarkable magnetic changes and disturbances over the surface of the earth.

The "Red Prominences" of the Sun.—During an eclipse of the sun, red flames or lights termed "red prominences" are seen to shoot out from the eclipsed orb. These "red prominences" are luminous vapours existing round the sun. The outer bright part is termed the "coronal atmosphere," and the vapours, the chromosphere. "The luminosity of the prominences is intense," says Secchi, "and they rise often to a height of 80,000 miles, and occasionally to more than twice that; then bending back, they fall again upon the sun like the jets of our fountains. Then they spread into figures resembling gigantic trees more or less rich in branches." (*See* also SOLAR ECLIPSE.)

Sun Spots.—When the sun is examined through a telescope, its surface is found to be marked by black spots, edged with a penumbral fringe of uniform shade. Sometimes these spots appear singly, sometimes in groups. They are not permanent, but undergo changes of form from day to day, or even from hour to hour, which is believed to indicate a gaseous form of matter. They seldom last longer than six weeks, and often only a few hours. When they disappear, the black centre or nucleus always vanishes before the penumbra. Schwabe of Dessau, having perseveringly studied these spots for more than a third of a century, arrived at a remarkable law of periodicity affecting them. He found that they gradually increased in number up to a certain period, then decreased to a certain period, then increased again, and so on. According to this investigator, the cycle is completed in ten years. These spots, which are believed by some philosophers to have an influence upon the climate of the earth, were among the earliest discoveries of the telescope. It is now believed they are probably caused by fierce tornadoes which sweep over the sun's surface, that tear out maelstroms in its envelope, which we call sun spots.

SUNDIAL, *sun'-di-al.*—An instrument to show the time of day by means of the shadow of a style on a plate. Up to comparatively recent times, the science of constructing sundials, under the name of *Gnomonics*, was an important part of a mathematical course. As long as watches were scarce and clocks not very common, the dial was in ordinary use as a timekeeper. A large number of mathematical works of the 17th century are on the subject of dialling. The sundial consists of two parts: first, the style, the shadow of which points out the time; and, second, the dial, which is a plate of metal, horizontal or otherwise, on which are marked the direction of the shadow for the several hours, and their divisions and sub-divisions.

SUN-FLOWER. (*See* HELIANTHUS.)

SUN-STROKE, OR COUP DE SOLEIL, *sun'-stroke.*—Is a disease affecting those who are exposed to the direct beams of a hot sun, particularly during any labour or active exercise. It is not uncommon among our troops in India in long marches. They fall down insensible, and often die in a very short time. The nature of this complaint is not well understood. According to some, it is a sort of apoplexy, while others hold that it is more of the nature of concussion. It would appear that the sun's rays act upon the brain like a shock, suddenly and extensively influencing the nervous system, and arresting the movements of the heart. The natives of India adopt the system of pouring cold water upon the head in such cases. Stimulants are also found to be of benefit, while bleeding, on the other hand, is not recommended.

SUPERPHOSPHATE OF LIME, *su-per-fos'-fait.*—This term is applied to a mixture consisting of burnt bones 2 parts, sulphuric acid 1 part, and water 3 parts, allowed to stand for a few days in a warm situation. It is largely used as a manure for land. (*See* MANURES.)

SURGERY, *sur'-je-re*, OR CHIRURGERY, *ky'-rur'-je-re* (Gr. *cheir*, hand, and *ergon*, work).—That branch of the healing art which employs manual procedure, whether by instruments or not, in the reparation of injury or cure of disease, as distinguished from the practice of medicine, which treats disease by the administration of drugs or other substances of a sanitive tendency. This distinction, however, exists more in name than in reality, for the two are indissolubly connected, and the successful practice of the one is, of necessity, dependent on a knowledge of the principles of the other.

History.—Surgery may well be regarded as coeval with man in his fallen state, for the human body becoming then susceptible of injuries, the ingenuity of the sufferer would be excited to remedy them, and appliances for that purpose would be resorted to. Among the early Egyptians it must have existed in a considerably advanced state; for the scientific manner in which they embalmed their dead shows that they must have possessed a considerable knowledge of the human body and of the nature of drugs. The Greeks probably derived their medical knowledge from the Egyptians. The father of surgery is said to have been Chiron the Centaur, a native of Thessaly, and celebrated for his skill in the application of soothing herbs to wounds and bruises. His pupil Æsculapius was still more celebrated, and is believed to have flourished half a century before the Trojan war. He was fabled to be the son of Apollo, and after his death became the god of physic. His two sons, Podalirius and Machaon, occupy a distinguished place among the heroes of the Iliad. For upwards of 600 years, little or no progress appears to have been made in this art, the practice of which was confined to the Asclepiades, or reputed descendants of Æsculapius. Hippocrates did more for the improvement of surgery and medicine than all who had preceded him, and freed them from many of the absurdities with which they had been invested. So correct were his observations, and so accurate his descriptions, that they are referred to as authoritative even at the present day. His operations appear to have been conducted with boldness and decision, and indicate a considerable acquaintance with the art. Some of his discoveries, which had fallen into disuse, have been revived in modern times as new inventions. After the death of Hippocrates (B.C. 361), surgery made little progress in ancient Greece. Among the more distinguished of his followers were Ctesias, Diocles, Carystus, and Praxagoras. Of the Alexandrian school, the two great heads were Herophilus and Erasistratus, who, according to some accounts, were the first who practised human dissection. Among their followers were Xenophon of Cos, Mantius, Andreas of Carystus, and Ammoricus. For nearly the first 600 years of its existence, Rome had no regular practitioner of medicine, and they trusted for cures mainly to spells and incantations. A Greek, Archagathus, of the Alexandrian school, having established himself at Rome as a surgeon during the consulates of Lucius Æmilius and Marcus Livius, was, after a time, on account of the prejudice existing against his profession, obliged to leave the city. Shortly after, however, Asclepiades, a native of Bithynia, established himself at Rome, and contrived so to ingratiate himself with the people that he was not only tolerated, but acquired some degree of popularity, and paved the way for future practitioners. Rome itself did not produce any medical man of note before the time of Celsus, the contemporary of Horace, Virgil, and Ovid. He is worthy to be compared with Hippocrates for his sound practical knowledge; and many of his surgical operations and remarks are far from being obsolete, impressing us with a high idea of his ingenuity and judgment. He has left us a complete and excellent digest of the medical and surgical knowledge of his time. Between Celsus and Galen, a period of upwards of 150 years, the only practitioners of note at Rome were Aretæus, a native of Cappadocia, Heliodorus, Antyllus, Rufus, and Archigenes. Galen was born at Pergamus, in Asia Minor, A.D. 131, and after studying at Smyrna, Corinth, and Alexandria, he ultimately settled at Rome, where he acquired great reputation both as a practitioner and public lecturer. Being a man of great erudition, brilliant genius, and indomitable industry, he produced works which exerted a most powerful influence over the practice of medicine, and rescued it from many of the errors with which it was encompassed. Indeed, for a period of 1,300 years, his opinions were received as oracular in the schools of all civilized countries. Passing over Oribasius, Aëtius, and Alexander of Trallis, we come to Paulus Ægineta, who flourished about the middle of the 7th century, and made both large and important contributions to surgery. His remarks are the more valuable from being no mere theories, but the results of practical observation and experience. The Arabs first became acquainted with medicine through translations of the Greek authors, and a flourishing medical school was established at Bagdad, under the fostering care of the celebrated caliph Haroun al Raschid, in the 9th century. The first Arabian surgeon of note was the celebrated Rhazes, who presided over an hospital at Bagdad, about the beginning of the 10th century. In the earlier part of the 11th century flourished Avicenna, whose works remained for nearly 600 years of great authority on medical subjects. More distinguished, however, in the department of surgery was Albucasis, who died in 1122. He was very skilful as an operator, and introduced a number of new instruments. To the Arabs, about the middle of the 12th century, we are indebted for the distinct separation of medicine and surgery. Up to this time they had been both practised indiscriminately. A knowledge of the Greek and Arabian systems of medicine was introduced into Italy, at Salerno, in the beginning of the 11th century, and this school soon acquired great celebrity as a seat of medical learning, whence knowledge was slowly diffused over the different countries of Europe. Among the early Christians, the practice of physic was viewed by the clergy as their peculiar province. The council of Tours, however, in 1163, prohibited the clergy from in any way causing the effusion of blood in the healing of disease, and surgery was in consequence abandoned to the uneducated laity, and sunk to a deplorable state of prostration, being in the hands of barbers, farriers, cobblers, and such like. Down then to the middle of the 16th century, we meet with no name of note in this science. Ambrose Paré, a Frenchman, was among the first to raise surgery from its prostrate condition, and his works exerted a most powerful and beneficial effect upon his followers. In the 17th century, Italy produced Cæsar Magatus, Tagliacotius, Marcus Aurelius Severinus, and Fabricius Aquapendente; Germany, Hildanus, Scultetus, Aurmann, and Heister; Holland, Rau, who is said to have been, perhaps, the most successful lithotomist that ever lived; and England, Wiseman, surgeon to Charles II. In the following century, we have in France the two great names of Petit and Desault, and in England the not less distinguished names of Perceval Pott and John Hunter, followed by Cheselden, Douglas, White, and Sharp. In Italy, during this century, flourished Lancisi, Morgagni, Bertrandi, Troja, and Scarpa; and in Germany, Schmucker, Richter, and Haller. It would be invidious, if it were not impossible, to name the most distinguished surgeons that this 19th century has produced, and in no country are they more numerous or more distinguished than in our own. Abernethy, Cooper, Liston, and Syme, with Dupuytren, Roux, and Lisfranc, are among the names that are well known. In no branch of medical science is progress more marked than in that of surgery, the rude and imperfect instruments that were formerly in use having been superseded by others of the most perfect form and delicate structure; red-hot irons and boiling pitch are no longer applied to stanch a bleeding wound, while the knowledge of when an operation is necessary, and when it ought to be performed, not among the least important qualifications of a surgeon, was never before in so advanced a state. The discovery of chloroform has, moreover, been of the greatest benefit to the suffering patient.

Qualifications of a Surgeon.—The skilful surgeon requires to be possessed of some of nature's choicest gifts. He requires to be possessed of a strong steady hand, a clear quick sight, and great coolness and courage. Dexterity in the use of the instruments is also of the utmost importance, and this is best acquired by diligent practice in the dissecting-room, which is further of use in giving him a minute acquaintance with the anatomy of the different parts. It is of great advantage to the surgeon to be ambidextrous, or to possess the power of using either hand equally well. Hence, in order to be an eminent surgeon, there is required a combination of gifts, natural and acquired, such as falls to the lot of few men. (The various divisions of surgery will be found noticed in other parts of this work. *See* AMPUTATION, DISLOCATION, LITHOTOMY, &c.)

SURIANACEÆ, *su-re-an-ai'-se-e.*—In Botany, a natural order of *Dicotyledones*, subclass *Monochlamydeæ*. There is but one known species, which is common on the sea-coast in the tropics. It resembles in many respects the order *Phytolaccaceæ*, but is at once distinguished by the possession of petals and by the stamens being opposite to the sepals.

SWALLOW, *swol'-lo* (Sax., *swelgan*).—This is the only species of the group *Hirundo*, which with us is called a swallow, the others being either martins or swifts. The chimney or house swallow, as it is frequently called, is supposed to hatch and breed in Africa, probably to the south of the equator, and is a periodical visitor to this country, generally arriving about the 10th of April, and remaining six months. The general colour of the swallow is black, with reflections of grayish-blue; the throat and forehead are deep reddish-brown, and there is a white spot on the inner web of each of the tail-feathers, with the exception of two in the middle, which are the shortest; the lateral tail-feathers are very long, and give a remarkable forked appearance to the tail. The upper part of the breast is black, the lower part and belly white; the whole length is about eight inches and a half, of which the elongated tail-feathers measure nearly five inches; the wings are long and pointed, reaching beyond the end of the second tail-feather. On reaching this country, they form their nests in chimneys, under the eaves of houses, old ruins, &c. The nest is formed of small portions of moist earth, which the bird may be seen collecting at the edges of ponds or the margins of puddles by the road-side. The nest is made in an open saucer-shaped form, and is lined with feathers. The eggs are generally from four to six in number, white, speckled with ash-colour, and dark red. Two broods are produced in the season. Swallows are very active, gliding and darting about with great lightness, and apparently very little motion of the wing, every stroke sending them forward as if shot from a bow. The note of the adult swallow is a soft and sweet warble.

SWAN, *swon* (Sax., *swan*).—A genus of web-footed swimming birds (*Cygnus*), found on the rivers and small pools of fresh water, and distinguished by their graceful and majestic appearance. In some of the species the swans approach the geese in many of their characters, whilst the typical ones differ considerably.

The Leading Characteristics of the swans, considered as a genus of *Anatidæ*, are these:—The bill as wide at the tip as at the basal part, and higher than wide at the base; the nostrils are pierced about the middle of the length of the bill, and the neck is very long, as compared with that of the other web-footed birds. The colour of the plumage is in general pure white, but a black species exists. They swim rapidly, and their flight is powerful and long-continued; they live in society, but in the breeding time they are strictly monogamous, and the pairs take up their nesting-grounds at some distance from each other. They make their nests near the margin of the water, upon the ground, and attain a great age. They feed generally upon seeds, roots, and other parts of aquatic plants which are blanched and succulent by being under the water; but it is asserted by some writers that they also eat frogs, insects, and worms. Their flesh is hard, black, and rank in the old ones, and not very good in the young ones. Their skins, feathers, and down, and especially the latter, are used for several purposes.

Varieties.—There are several species, and one, the black swan of Australia, was long regarded as a bird impossible to be found.

The Wild Swan, Whistling Swan, or Hoopoe (Cygnus ferus), so called on account of the peculiar note uttered by this bird, is a winter visitor to the British islands: it also visits Holland, France, Provence, and Italy, and sometimes goes as far south as Egypt and Barbary. It is a native of the northern parts of both the Eastern and Western continents, and is the first of all the *Anatidæ* to return north. The bill is black, and depressed in its anterior part, whilst the posterior is quadrangular and yellow. The plumage is white, but with a yellowish tinge on the head and upper part of the hind neck. The length of the full-grown bird is rather more than four feet and a half.

The Tame Swan, or Mute Swan, is one of the most graceful and largest of British birds, and differs from the wild swan in that it has the anterior portion of the beak yellow and the base black, with a prominent black tubercle or knob on the upper part in front of the forehead. It is rather shorter than the whistling swan, but longer in the wings.

SWIETENIA, *swe-ten'-e-a.* (*See* MAHOGANY.)

SWIFT.—A general name for the *Cypselidæ*, birds classed by some ornithologists as a sub-family of the swallows, but by others as a separate family. They resemble swallows in habits and general form, but the bill is more curved, and there are no bristles at the base. They fly swiftly and gracefully, and feed exclusively on insects, which they capture on the wing. They make their nests in hollow trees, holes in buildings, and crevices in rocks. Like the swallows, they are migratory. The common European swift, or black martin (*C. apus*), is about seven inches long, with a forked tail; the upper part of a blackish-brown colour, with a green gloss, and the throat grayish-white. It appears in this country from May to August. The white-bellied swift (*C. melba*), common in Southern Europe, is a slightly larger bird, of a grayish-brown colour on the back and white beneath. There are many species of swifts, both in the old world and the new. The esculent swift (*Collocalia esculenta*) is the principal maker of the nests which are a favourite article of food in China.

SWORD-FISH.—A genus of fishes (*Xiphias gladius*), remarkable for having the upper jaw prolonged somewhat in the form of a sword, and constituting at least one-third of the total length. The body is elongated, nearly round behind, but little compressed; upper part of the head nearly flat, slightly descending to the base of the sword, which is formed by an extension of the vomer, maxillary and intermaxillary bones. There are no proper teeth and no true tongue. The whole of the body is covered with a rough skin. The gills are peculiar, not consisting of fringes in the form of the teeth of a comb, as is usual among bony fishes, but each consisting of two large parallel laminæ, with reticulated surfaces. The whole of the under part of the body is of a fine pure silver-colour, shaded with bluish-black on the upper part. The sword-fish is sometimes more than twenty feet long, the beak included. It swims with greater swiftness than almost any inhabitant of the deep, and is possessed of vast muscular strength. It attacks and puts to flight the smaller cetaceous animals, notwithstanding its food is usually vegetable. The flesh of the adult is said to be hard but good, that of the young fish white, agreeable, and nourishing. The sword-fish is very abundant in the Mediterranean, where it has attracted much notice from very early times.

SYCAMORE (*see* ACER).—The tree so named in the translation of the New Testament is the Egyptian fig common in Egypt and Syria. (*See* FICUS.)

SYCONUS, *si'-ko-nus* (Gr., *sukon*, a fig).—A collective fruit, formed of an enlarged and more or less succulent receptacle, which bears a number of separate flowers. The fig is an example. What are commonly called seeds are in reality one-seeded fruits.

SYENITE, *si'-en-ite*.—A granitic rock composed of quartz, felspar and hornblende. It takes its name from the town of Syene, in Egypt, near which it is found.

SYLVIADÆ, *sil-vi'-a-de*. (*See* WARBLERS.)

SYMPATHY, *sim-path-e* (Gr., *sympatheia*, fellow-feeling).—An emotion stimulated by an unconscious imitation of the feelings of others. In physiology, the effect on an organ of the body, produced by pain in a corresponding organ.

SYMBOLS, CHEMICAL, *sim'-bols*. (*See* CHEMISTRY.)

SYMPHYTUM, *sim'-fi-tum* (Gr., *sumphuo*, I unite).—A genus of the natural order *Boraginaceæ*. *S. officinale* is the herb comfrey, which has always been reputed vulnerary. The young leaves and shoots are sometimes eaten as table vegetables. When bruised, comfrey forms an excellent bandage for broken limbs.

SYNCLINAL, *sin-kli'-nal* (Gr., *sun*, together; *klino*, I bend).—In Geology, when strata dip towards a common line of depression, the axis is termed synclinal, and the depression so formed is described as a trough or basin.

SYNCOPE. (*See* FAINTING.)

SYNTHESIS, *sin'-the-sis* (Lat.).—In Chemistry, a term applied to the putting together of different bodies to form new ones possessing distinct properties. It is directly opposed to analysis, which is the process of separating bodies into their proximate or ultimate constituents.

SYRINGA, *si-rin'-ga*.—A genus of the natural order *Oleaceæ*. *S. vulgaris* is the beautiful early-flowering shrub known as the lilac; it is a common ornament of shrubberies and suburban gardens. The shrub commonly known as the syringa is a distinct plant. (*See* PHILADELPHUS.)

SYRRHAPTES, *sir-rap'-tees*.—A genus of birds of the Grouse family. Only one species, *S. Pallassii*, is known. It is a native of the deserts of Tartary.

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TABASHEER, *tab'-a-sheer* (Pers.).—A silicious deposit in the joints of the bamboo. (*See* BAMBUSA.)

TACCACEÆ, *tak-kai'-se-e*.—The *Tacca* family, a natural order of *Monocotyledones*, sub-class *Petaloideæ*, consisting of perennial herbaceous plants with fleshy roots, parallel-veined stalked leaves, and regular flowers. There are two genera and eight species, natives of damp places in the hot parts of India, Africa, and the South-Sea Islands. The most interesting plant of the order is *Tacca oceanica*, the roots of which yield the starch known as Tacca starch, Tahiti arrowroot, or Otaheite salep.

TADPOLE, *tad'-pole* (Sax., *tad*, toad; and *pold*, a young one).—A young frog before it has disengaged itself from the membranes that envelop it in its first stage of life.

TALC, *talk*.—A mineral consisting principally of silicate of magnesia, occurring in crumbling, laminated, and foliated masses of a greenish or yellowish white. It resembles mica, but is much softer, and although flexible, is not elastic. It is used in the manufacture of crayons, for crucibles, as a grease absorbent, and in making porcelain. Much of the so-called commercial talc is mica. Talc enters into the composition of many rocks; such as talc-schist, chlorite-schist, steatite, serpentine, &c.

TALLOW TREE.—A Chinese tree (*Stillingia sebifera*), belonging to the family *Euphorbiaceæ*. It averages about 30 feet in height, has long and flexible branches, and leaves similar to those of the poplar. The fruit is three-lobed, with one seed in each cell, covered with a white tallow-like substance, used by the Chinese for the manufacture of candles. The name is also given to an herb growing to a height of about three feet in the southern parts of North America. The root has medicinal properties.

TALPIDÆ, *tal'-pi-de*. (*See* MOLE.)

TAMARICACEÆ, *tam-a-rik-ai'-se-e*.—The Tamarisk family, a genus of the natural order of *Dicotyledones*, sub-class *Thalamifloræ*. The plants of this order usually grow by the sea-side, and are most abundant in the basin of the Mediterranean. There are three genera and about 20 species. *Tamarix mannifera* produces a saccharine substance, which is known under the name of Mount Sinai manna. This is supposed to be an exudation produced by an insect which inhabits the plant.

TAMARIN, *tam'-a-rin*.—A genus (*Midas*) of small South American monkeys. The Silken monkey is of a golden-yellow colour, and is much prized as a pet, being very docile and playful.

TAMARIND. (*See* TAMARINDUS.)

TAMARINDUS, *tam-a-rin'-dus*.—In Botany, a genus of the natural order *Leguminosæ*. The well-known tamarind is the fruit of the species *T. indica*. It contains an agreeable, acidulous, sweet, and reddish-brown pulp, which is employed medicinally in the preparation of a cooling laxative drink. When the pulp is mixed with sugar, it forms a delicious preserve.

TAMUS, *tai'-mus*.—A genus of the natura order *Dioscoreaceæ*. *T. communis* is the common black bryony, a beautiful twining hedge-plant.

TANAGRINA, *tan'-a-gre-na*.—A large division of the Finch family of birds, peculiar to America, and almost entirely limited to the southern portion of the continent. About 220 species are known. The scarlet tanager (*P. rubra*) is one of the showiest of American birds. It is about 7 inches long, and the male, in the breeding season, is of a general bright carmine colour, with black wings and tail. Other species exhibit varied colours, but all are of great beauty.

TANSY, *tan'-se* (French, *athanasie*, contracted to *tanaisie*; from the Greek, *athanasia*, immortality).—A perennial herb, formerly cultivated in gardens, but now a roadside weed. The name is derived from some supposed preservative quality of the plant, or from its durable flowers. The leaves yield a volatile oil with a bitter aromatic taste, and, infused in spirits, have a reputation as a tonic, and was formerly supposed to be a remedy for dropsy and worms. The oil alone is poisonous, and has been used for criminal purposes.

TANTALIC ACID. (*See* TANTALUM.)

TANTALUM, *tan'-ta-lum.*—A rare metal, also known as columbium, found in certain minerals, the *tantalites* and *yttrotantalites*. Being so rare, and occurring in such small quantities, its characteristics as a metal have not been much studied. It is obtained by decomposing the chloride at a red heat with ammonia.

TANTALUS, *tan'-ta-lus.*—A genus of birds somewhat resembling storks. An African species (*T. ibis*) was formerly considered the Sacred Ibis of ancient Egypt, but it is a much larger bird. There is an American species (*T. loculator*), commonly known as the Wood Ibis.

TAPEWORM. (*See* ENTOZOA.)

TAPIR, *ta'-per.*—A pachydermatous animal (*Tapirus*), belonging to the order *Ungulata* and family *Elephantidæ*. There are three known species of the tapir, two of which inhabit South America, while the third is found in Sumatra and on the peninsula of Malacca. The characteristics of the genus are that the muzzle is prolongated into a short proboscis, which is simple at the end; the skin is covered with hair; the skull is of a sort of pyramidal form, resembling that of the pig, and the nasal bones are much arched, so as to give support to those muscles from which the proboscis depends; the tail is extremely short; the neck is high, and is furnished with a sort of mane formed of upright bristles; and in their form, generally, they are not at all unlike the hog family, with the exception that the legs are usually longer. The best-known species is the common American tapir (*Tapirus terrestris* or *Americanus*), which is nearly six feet long, and measuring about three feet and a half high. The skin is very thick, and covered with short brown hair, and it is found in nearly all parts of Southern America, from Panama nearly to the extreme south. It inhabits the most tropical forests, near water, in which it often bathes, and is more of a nocturnal than a diurnal animal. Another South American species (*T. villosus*), is distinguished from the former by the greater length of its hair. It is principally found inhabiting the Andes, at a height of some 3,000 to 3,600 feet above the level of the sea. The remaining variety—*Tapirus Malayanus*, or Indian tapir—is much larger than either of the species just described, measuring some seven or eight feet in length, and of proportionate height. It is of a very heavy, massive appearance, and is remarkable for the peculiar colouring of its body, its fore quarters being of a glossy jetty black, while its hind-quarters, back, and sides, are pure white. The proboscis or trunk is also developed more than in the American varieties. Hitherto it has only been found in Borneo, Sumatra, and Malacca.

TAR, *tar.*—A black viscid substance, consisting of a mixture of hydrocarbons holding solid matters in solution, formed during the distillation of wood or coal. Wood tar, or Stockholm tar, as it is often called, is largely used in ship-building. It is produced by a process of rough dry distillation of the resinous wood of the pine. When heated, the more volatile constituents evaporate, leaving behind the hard, black, shining substance known as pitch. Coal tar is similar in its character and composition to wood tar, but contains in addition many compounds not existing in the vegetable product. Tar is also obtained from slate, peat, and seaweed during the dry distillation of these substances, closely resembling wood and coal tar in its composition.

TARANTULA, *ta-ran'-tu-la* (Ital.).—A spider (*Lycosa Tarantula*) belonging to the family *Araneidæ*, the third order of the class *Arachnida*. The tarantula is a native of the south of Europe, and received its name from being common in the vicinity of Taranto, in southern Italy. It is the largest of European spiders, the body being nearly two inches long. Its bite is supposed by the natives of Italy to be only cured by the patient being made to dance violently to the sound of music. It lives on the ground, generally under stones, or in holes in the earth, the name is also given to a large spider (*Lycosa tarantula*) native of the Southern States of America, and the other species in the South-western States.

TARAXACUM, *ta-raks'-a-kum* (Gr. *tarasso*, I change, from its supposed effects on the blood).—A genus of the natural order *Compositæ*. *Taraxacum officinale* is the common dandelion. The root of this plant is very extensively employed as a medicinal agent, and is believed to possess aperient, diuretic, and alterative properties. It contains a bitter crystalline principle, to which it seems to owe its medicinal power.

TARRAGON, *tar'-ra-gon.*—An aromatic perennial herb of the same genus of *Compositæ* with the common wormwood, a native of Siberia and the region of the Caspian Sea. French cooks use the leaves and young shoots of the plant (named by them *estragon*) in salads, and to flavour vinegar, pickles, and mustard.

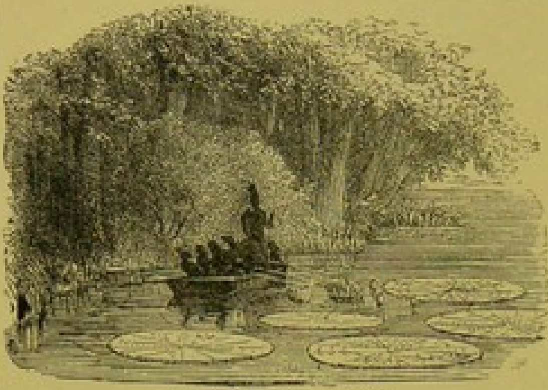
TARTAR, *tar'-tar.*—A whitish crust deposited from wines upon the insides of the casks in which they are stored. It consists essentially of the sparingly soluble bitartrate of potash. When purified, it crystallizes in oblique rhombic prisms of snowy whiteness, forming ordinary cream of tartar. Crude tartar, or argol, forms the chief source of tartaric acid.

TATTLER, *tat'-tler.*—Wading birds of the snipe family. They are swift fliers and runners, and go northward in the spring to breed. The flesh is much esteemed. The Tell-tale Tattler (*Gambetta metanoleuca*), known also as the Greater Yellow-legs, and the Stone snipe, are found in the temperate regions of North America and Mexico, mostly in marshy districts. The body is about 14 inches long. Another and smaller American species is the Spotted Tattler, or peet-weet.

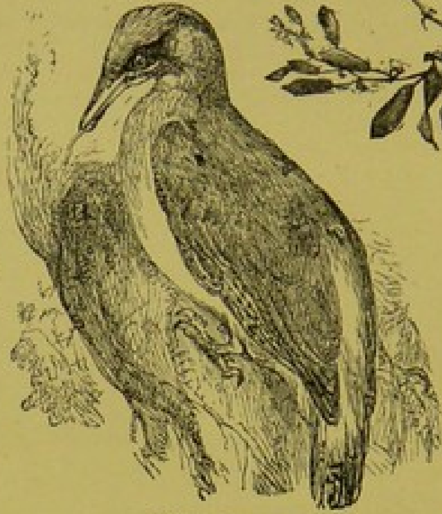
TAURUS, *taw'-rus* (Lat.).—In Astronomy, the Bull, one of the twelve signs of the zodiac, and the second in order.

TAXACEÆ, *taks-ai'-se-e* (Lat., *taxus*, the yew-tree).—In Botany, the Yew family, a natural order of *Dicotyledones*, sub-class *Gymnospermia*. Trees or shrubs, with continuous branches. Leaves usually narrow, rigid, and veinless; sometimes broad with forked veins. The plants of this order are natives of temperate regions, and of the mountains of tropical countries. (*See* TAXUS.)

TAXUS, *taks'-us* (Lat.).—The yew, the typical genus of the natural order *Taxaceæ*. *T. baccata*, the common yew, is an evergreen tree,



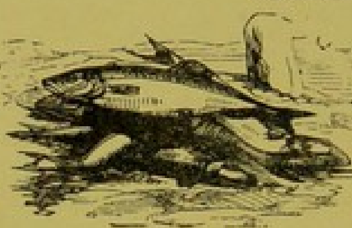
VICTORIA REGIA LILY.



WOODPECKER.

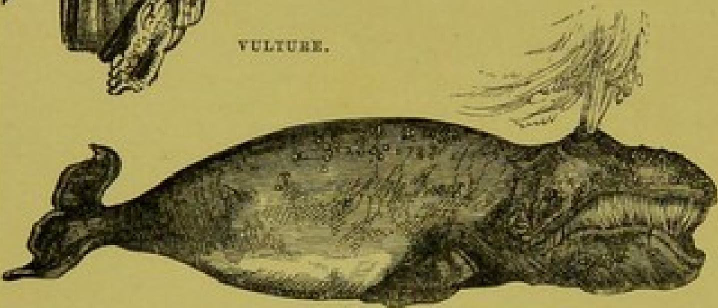
VANILLA.

VULTURE.

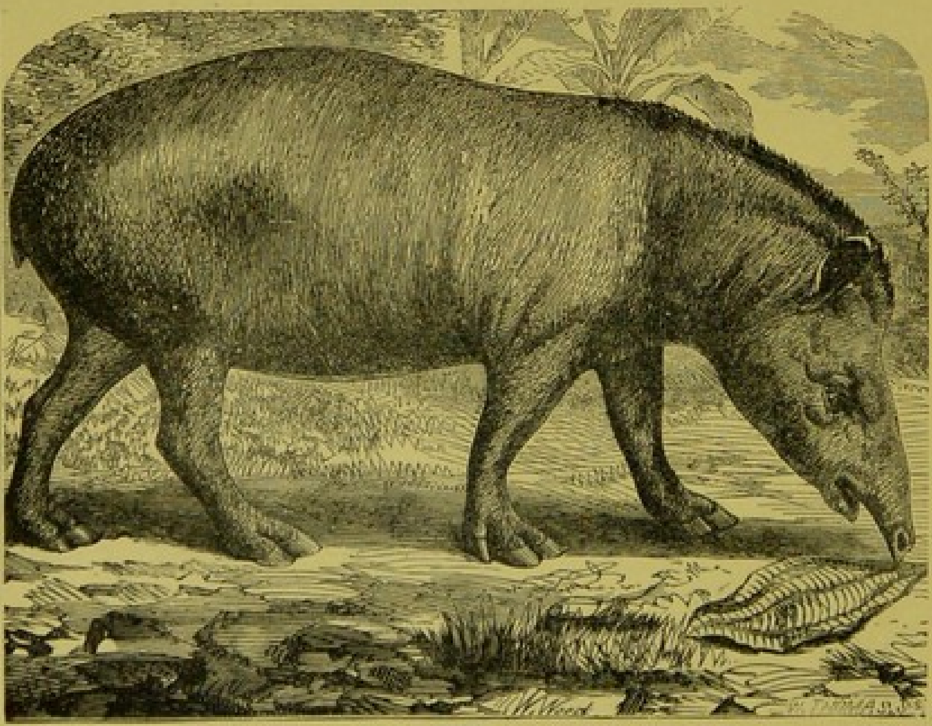


WHITEBAIT.

BRUSH TURKEY.



WHALE.



TAPIR.

VALERIAN.

WOLF'S BANE.

which often attains a great size. Specimens of remarkable antiquity are commonly seen in old churchyards. The timber is extremely durable and valuable, and was formerly much used for making bows. Its leaves and young branches act as narcotico-acrid poisons when eaten by man or the lower animals.

TEA, *te* (Chinese, *tcha*).—The dried leaves of a plant of the genus *Thea*. In a wild state, this plant is a bushy shrub, sometimes attaining the size of a small tree; but in cultivation it is kept down by pruning. In South-eastern Asia it is extensively cultivated through a wide range, from India to Japan; but China is the great tea-producing country, although great and successful efforts have been made to grow it in Assam and the north-eastern provinces of India. In North America, it thrives in Carolina and Georgia and on the Pacific coast. The quality of tea is much influenced by the soil on which it grows, slopes of hills being the most favourable situation.

TEAK, *teak* (*tekkn*, its name in Malabar).—The name given to two kinds of hard and durable timber. East-Indian teak, which is so extensively employed for shipbuilding, is the wood of *Tectona grandis*, a tree belonging to the natural order *Verbenaceæ*. African teak is the produce of *Oldfieldia Africano*, one of the *Euphorbiaceæ*.

TEAL, *teal* (Dutch, *taling*).—A bird belonging to the family *Anatinæ*, or true ducks, the characteristics of which are given in a former article. It is the smallest of the wild ducks which visit this country in the winter, and has a black bill, with the head and upper parts of a bright bay colour. It arrives in this country very late in the autumn, and is found principally along the southern and westward coast of England and Ireland. There are various American species, larger in size.

TEARS, *teerz* (Lat., *lachrymæ*).—The limpid fluid secreted by the lachrymal glands, and flowing on the surface of the eyes. They serve to prevent the friction of the eyelids on the eyes, to keep the cornea moist, and to wash away any extraneous bodies that may have fallen into the eye. (*See* EYE.) The secretion of tears is stimulated by strong emotion, especially the excitement caused by grief.

TEAZLE, *tee'-zel* (from Ang.-Sax., *tæsan*, to tease).—The ripened flower-heads of *Dipsacus fullonum*, the representative of a small family of plants nearly related to the *Compositæ*. The various species of the teazle are biennial or perennial, have coarse rough leaves, and the branches are terminated by an oblong head, consisting of small flowers, each in the axil of a bract, which appears on a strong scale when the seeds are ripe.

TEETH, *teeth* (Sax., *teth*; Lat., *dentes*; Gr., *odontes*).—Hard bodies attached to parts of the mouth or beginning of the alimentary canal, and peculiar to vertebrated classes of animals. They are principally adapted for seizing, tearing, dividing, pounding, or grinding the food; but in some they are modified to serve as weapons of offence and defence; in others as aids to locomotion, means of anchorage, instruments for uprooting or cutting down trees, or for the transport and working of building materials. They are characteristic of age and sex; and in man they are also subservient to beauty and speech. A tooth is composed of three different substances—dentine, *crusta petrosa*, and enamel. Dentine, which forms the greater part of the body of the tooth, is composed of about 72 per cent. of calcareous matter and 28 per cent. of organic substance. It is traversed throughout by very minute cylindrical channels, known as *canaliculi*, which radiate from a central cavity towards the external surface of the dentine. In the central cavity is contained the pulp of the tooth, a soft sensitive substance supplied with blood-vessels and nerves. The *crusta petrosa* is a thin layer of bony tissue attached to the exterior of the dentine and the fang of the tooth, and serving to connect it more firmly with the socket. The enamel is very close in texture, perfectly uniform and homogeneous, yet presenting a fibrous arrangement. It is the hardest portion of the tooth, and in many cases containing as much as 95 per cent. of calcareous matter. It is seen only at the crown of the tooth, the upper and outer part of which consists of this substance. In the human infant, the teeth usually begin to cut through the gum about the sixth or seventh month after birth, and the temporary or deciduous set of teeth, twenty in number, are generally completed by the end of the third year. The period of dentition is usually a time of disordered health to children, especially if anything occurs to prevent the ready yielding of the gum to the pressure of the tooth below. The deciduous teeth begin to fall out about the age of seven or eight, and are replaced by the adult or permanent set. These are 32 in number, or 16 in each jaw—namely, four incisors or front teeth, two cuspidati or canine teeth, four bicuspidati, and six molars. The last two molars are called *dentes sapientiæ*, or wisdom teeth, on account of their not making their appearance till about the age of eighteen or twenty, or later, when one is supposed to have reached the years of discretion. The teeth are subject to decay, and require to be kept clean by frequent brushing.

TELEOSAURUS, *te-le-o-sau'-rus*.—A genus of fossil crocodiles of the secondary epoch, differing from the living crocodiles in having biconcave vertebræ. The name is now restricted to the species found in the Oolite, especially the *T. cadomensis*, or crocodile of Caen, from the limestone of Normandy. It had a very long flattened muzzle, and thick rectangular scales, forming 10 regular series of 15 or 16 each. The length of the animal was about 20 feet.

TELIOSTS, *te'-li-osts*.—A term applied to common bony fishes from other well-ossified skeletons.

TELLURIUM, *tel-lu'-re-um* (Lat., *tellus* the earth).—This elementary substance, although generally classed and described as a metal, belongs to the sulphur and selenium group, to which bodies it presents a strong analogy. Tellurium is brilliant, crystalline and brittle, resembling bismuth in colour, and fusing between 800° and 900° Fahr., above which temperature it may be distilled in a current of hydrogen. According to Mitscherlich, it crystallizes in a rhombohedral form. It conducts both heat and electricity, though imperfectly. Like sulphur and selenium, it dissolves to a slight extent in sulphuric acid, from which it may be precipitated unchanged by dilution. When strongly heated in the air, it takes fire, burning with a brilliant blue flame edged with green, emitting a peculiar characteristic odour, and producing fumes of tellurous acid. Tellurium occurs in nature in small masses, irregularly lamellar and crystallized in six-sided prisms, at the mine of Maria Loretto, near Lalatana Transylvania, and a combination with gold and silver, in various parts of North America. It was discovered in 1782 by Von Reichenstein, but first investigated and named by Klaproth in 1798. With oxygen, like sulphur and selenium, it forms two combinations—tellurous acid, and telluric acid. Tellurium is interesting as being the connecting link between the metals proper and the metalloids.

TEMPERAMENT, *temp'-er-a-ment* (Lat., *temperare*, to mix together).—Literally, a tempering or mixing together, and is defined in physiology to be "a peculiar state of the system, common to several individuals, which results from the various proportions in which the elementary parts of the human body are mixed up together, and which gives rise to a tendency to certain phenomena." The ancients paid considerable attention to the subject of temperament, of which they distinguished four kinds, according to the preponderance of one or other of what they regarded as the four primary component parts of the human body: namely, blood, phlegm, yellow bile, and black bile; hence the sanguineous, phlegmatic, choleric, and melancholic or atrabilious temperaments. Various attempts have been made to improve upon this classification, but with some modifications it still continues to be that generally adopted by medical writers, but many modern physiologists add the nervous temperament. The sanguineous temperament is characterized by a florid complexion, soft skin, blue eyes, red or auburn hair, large arteries, and frequent pulse. Persons of this temperament are of great sensibility and mobility, peculiarly liable to diseases and excitement, fevers, inflammation, hæmorrhages, &c. The melancholic temperament is marked by a greater rigidity of the solids, dark complexion, black hair, small arteries, slow circulation, not easily moved, but of great steadiness of purpose. They are subject to hypochondriasis, apoplexy, and diseases of the liver. The bilious temperament is distinguished by black curling hair, dark eyes, a swarthy and at the the same time a ruddy complexion, a hard, lean, slender body, a full, quick, strong pulse, large veins, an obstinate and violent temper. The phlegmatic temperament is distinguished by great smoothness of the skin, a white, soft, full, plump body, small and almost imperceptible veins, and light thin hair growing sparingly. The prominent character of the nervous temperament is a great excitability of the nervous system, and the preponderance of the emotions and impulses over the reason and will; the muscles are small and soft and the form generally slender. Rarely do we meet with any of these temperaments in a pure form, but usually with two or more of them in combination. The happiest condition of a human being is when there is a well adjusted combination of these various conditions, when, in the words of Hamlet, the man is "not passion's slave," but his "blood and temper are so well commingled, that he is not a pipe for Fortune's finger to play what stop she please."

TEMPERATURE, *temp'-e-ra-ture* (Lat., *temperatura*).—A definite degree of sensible heat as measured by the thermometer. Thus we say, a high temperature, a low temperature, to denote a manifest degree of heat or cold. Temperature, in general, denotes the degree of free caloric which a body appears to possess when compared with other bodies, or, in other words, the state of a body in relation to its capability of producing in other bodies the effects arising from the presence of free caloric.

TEMPLES (Lat., *tempora*, literally, times).—The lateral and flat parts of the head above the ears; so called because time, or the age of an individual, is denoted by the hair becoming first gray here. The temporal bones are two irregular-shaped bones, one on each side of the head, connected with the occipital, parietal, and sphenoid bones. The temporal muscle is situated in the temple, and inserted into the coronoid process of the lower jaw, its principal use being to draw the lower jaw upwards, as in biting. The temporal artery is a branch of the external carotid, which runs on the temples and gives off the frontal artery.

TENCH, *tensh*.—A well-known fish (*Tinca vulgaris*) belonging to the Carp family, or *Cyprinidæ*. It is distinguished, in common with the family, by having no adipose dorsal fin, a scaly head, and a small mouth destitute of teeth. (*See* CARP.)

TENDON, *ten'-don*.—The fibrous cord or expansion by which a muscle is connected with the surface of bone. Tendons are composed of parallel bundles of white, inelastic, inextensible fibrous tissue, the spaces between which are occupied by thin layers of loose areolaig tissue, with a small proportion of elastic fibres, sufficient to allow a slight gliding motion of the different tendinous bundles upon each other.

TEPHROSIA, *te-fro'-ze-a* (from Gr., *tephros*, ash-coloured, gray).—A genus of the natural order *Leguminosæ*. *T. Apollinea* and *toxicaria* are used in Africa for the preparation of a blue dye resembling indigo. The latter, as well as other species, are used as fish-poisons; they stupify the fish, which are then readily taken by the hand. The leaflets of *T. Apollinea* are sometimes employed in Egypt to adulterate Alexandrian senna.

TERATOLOGY, *ter-a-tol'-o-ge* (Gr., *teras*, a monster, *logos*, a discourse).—That branch of physiological science which treats of the malformations and monstrosities of plants.

TERMINALIA, *ter-min-ai'-le-a*.—A genus of the natural order *Combretaceæ*. The fruits of *T. Chebula* are largely imported into this country under the name of *Myrobalans* or *Myrabaloms*. They form good durable yellow and black dyes, and are also used in tanning. The leaves are in bunches at the end of the branches; hence the name, from Lat., *terminus*, end.

TERMITES, *ter'-mites*.—The proper name of the insects commonly known as white ants. Though they resemble the common ants (*Formica*) in their social habits, in other respects they present many points of difference. They constitute an extensive and important family of the *Neuropterous* order, chiefly confined to the tropics, where they perform no inconsiderable share in the necessary business of removing from the earth's surface the carrion that cumbers it. Like the common ant, the white ants live in communities, and are, like them, omnivorous. Like the familiar "little brown ant," too, the white tropical insect is, at a certain period of its existence, furnished with wings to expedite its emigration. At no time, however, does the general form of the two insects agree. The antennæ of the white ants are thread-shaped, and composed of about twenty joints, and the eyes are rather small, but prominent; the body is depressed, and the mouth very similar to that of the *Orthoptera*, with the four-cleft lower lip, the wings slightly transparent, and the legs short. As destroyers, they certainly deserve place next to the locusts. Nothing is safe from the white ant's insatiable appetite. Their tactics in attacking a building are very peculiar. While some of them are busy gutting the timbers that support it, others ascend from them, entering a rafter or some other part of the roof, in search, as it would seem, of the thatch, which they appear to relish more than any other portion of a house. If they find it, they bring up wet clay, and build galleries through the roof in various directions as long as it will support them. In this manner a wooden house s speedily destroyed, and all that is contained in it is, at the same time, subjected to their ravages. These wonderful edifices known as ant-hills are built of earth or sand agglutinated together. The fecundity of the female of this species is truly wonderful. She and her partner are incarcerated in a cell by the neuters, and are there regularly supplied with food; and, after impregnation, on the enlargement of the ovaries, her abdomen swells to the enormous size of nearly two thousand times the rest of her body. As soon as she begins to lay eggs, they are conveyed away by the neuters to the prepared cells, which, in conjunction with the magazines of provisions, occupy the interior of their nests. It is said that she lays as many as 80,000 of these eggs in the course of twenty-four hours. So marvellous a fecundity would speedily everwhelm the earth, did it not happen that comparatively few reach maturity, and that birds, beasts, and fishes devour them in shoals. The true ants, however, are their worst enemies, and prey on them with the most savage voracity, especially at the period of their swarming. When roasted, they are highly esteemed by the natives as food. The largest and best known species is the warrior white ant of Africa. In each nest there are a king and queen, and about a hundred workers to one soldier. The worker is about a quarter of an inch long, and the soldier about twice that size.

TERN.—The proper name of the Gull family of birds and sub-family *Sterninæ*. (*See* GULL.) The largest species is the Caspian Tern, which is about 21 inches long, with an expanse of wing of 51 inches. The back and wings are of a pale bluish ash-colour, the upper part of the head black, with a greenish gloss, the quill shafts and the under plumage white, the bill vermillion, and the legs and feet black. It is found in the vicinity of the Caspian Sea, in most parts of Europe, in Africa, and on the north-eastern coast of North America. The Cayenne, or Royal Tern, is found on the Atlantic coast of North America, and also in California. There are various other species, including the Arctic Tern, a rather smaller and very handsome bird.

TERNSTRŒMIACEÆ, OR CAMELLIACEÆ, *tern-strem-e-ai'-se-e.*—The Tea or Camellia family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*. The name was given in honour of Ternstrœm, a Swedish naturalist. The plants of this order are ornamental trees or shrubs, natives chiefly of South America, a few being found in the East Indies, China, and North America, and one only in Africa. Some species from China and North America are cultivated in Europe. The *Camellia japonica* and the China tea-plants belong to this order. (*See* CAMELLIA and THEA.)

TERRA JAPONICA, *ja-pon'-i-ka.* (*See* CATECHU.)

TERRAPIN, *ter-rap'-in.*—A name commonly applied to several species of land tortoises; but in the United States generally limited to the few fresh water species of the family *Emydoidæ*, which are extensively used as food. The Yellow-bellied terrapin is 12 inches long, and about 11 inches high. It lives in stagnant ponds and pools, and is a native of Virginia and Georgia. The Red-bellied terrapin is met with farther north. The largest species is the Florida terrapin, which is 15 inches long and 10 inches wide. The Salt-water terrapin is a much smaller species, found from Rhode Island to Florida, and in the Gulf of Mexico. The flesh is considered to be excellent.

TERRESTRIAL MAGNETISM. (*See* MAGNETISM.)

TERRIER, *ter'-re-er* (Fr., from Lat., *terra*, earth).—A small variety of domesticated dog or hound, so called from its propensity to pursue and attack its prey in subterranean retreats. If not indigenous in England, it was very early introduced by the primitive inhabitants. Even a considerable mixture with other breeds does not impair its boldness, hardiness, fidelity, vivacity, and vermin-hunting propensities. There are two well-marked varieties, the result of fancy or accident. One, the English terrier, is smooth, rounded, elegant in shape, usually black, with tan spots over the eyes, and the same tint on the legs and the lower parts; it is occasionally white; the nose is sharp, the eyes bright, ears pointed or slightly turned down, and the tail carried high and bowed over the back. The other, the Scotch terrier, the oldest and purest breed, has shaggy and wiry hair, a shorter and fuller muzzle, bearded snout and face, stouter limbs, less elegant form, and a pale sandy or ochre colour. The terrier has an acute sense of smell, and is a good attendant on a pack of hounds, forcing foxes and other game from their coverts and dens. In England, the terrier blood is visible in most sheep and cattle dogs; but the most prized variety is the bull-terrier, from a cross with the bull-dog, some of whose qualities it inherits. It is generally white, with some black about the head. The Maltese terrier is a species of dog about the size of a ferret or weasel, found in Malta and other islands in the Mediterranean, generally a great favourite with ladies. They are very faithful and affectionate to their owners, while they are very ill-tempered towards strangers.

TERTIARY SYSTEM, *ter'-she-a-re* (Lat.).—In dividing the stratified crust of the earth into primary, secondary, and tertiary formations, the early geologists regarded as tertiary all that occurs above the chalk. In geology the term is still retained, but the advance of the science has rendered it necessary to restrict and modify its meaning. Taking the formations as they occur in Europe, and especially in Britain, the general arrangement of the tertiary system is as follows:—Post-Tertiary, which includes the recent and superficial accumulations occurring above the boulder-drift. In the second place comes the Tertiary System, properly speaking, which includes the *Pleistocene*, the *Pliocene*, the *Miocene*, and the *Eocene*. (*See* GEOLOGY.)

TESTUDINATA, *tes-tu-di-na'-ta* (Lat., *testudo*, a tortoise).—A term applied by Klein and Agassiz to designate tortoises and turtles. They are generally divided into four families—*thalassites*, or marine turtles; *potamites*, or river tortoises; *elodites*, or marsh tortoises; and *chersites*, or land tortoises, which rank highest in the scale. (*See* TORTOISE and TURTLE.)

TESTUDINARIA, *tes-tu-di-nai'-re-a*.—A genus of monocotyledonous plants, belonging to the natural order *Dioscoreaceæ*. One species is *T. elephantipes*, the tortoise-plant of the Cape, or elephant's foot. (*See* ELEPHANT'S FOOT.)

TETANUS, *tet'-a-nus* (Gr., *tetanos*, from *teino*, I stretch).—A disease characterized by a violent and rigid spasm of many or all of the muscles of voluntary motion. It occurs much more frequently in warm than in cold climates, and frequently arises from some irritation of the nerves, in consequence of local injury by puncture, incision, or laceration. In some instances it comes on suddenly and with great violence, but more frequently its attack is gradual. The most common form of the disease is known as locked jaw. Frequently, however, the disease extends farther, and the muscles of the spine become affected, so as to bend the body forcibly backwards, or, on the other hand, the muscles of the abdomen are affected, and the body bent forwards; and sometimes the muscles both before and behind are affected. These spasms are attended with the most severe pain, but seldom with any fever. This disease is frequently fatal, and, unfortunately, it too often resists every mode of treatment.

TETRAHEDRON, *tet-ra-he'-dron*.—In Geometry, a regular solid, bounded by four equilateral triangles, so that, when set upon any side, it has the appearance of a pyramid.

THALAMIFLORÆ, *thal-a-mif'-lo-re* (Gr., *thalamos*, a bed).—A sub-class of *Dicotyledones*, characterized by flowers usually furnished with both calyx and corolla, the latter composed of distinct petals inserted on the thalamus, and by the stamens being hypogynous, or adherent to the sides of the ovary. Seventy natural orders are included by Professor Bentley in this sub-class.

THALAMUS, *thal'-a-mus* (Gr., a bed or couch).—The apex of the peduncle or floral axis, upon which the different whorls of a solitary flower are arranged. In the majority of plants the thalamus is a little flattened surface or point, in no way remarkable; but in some plants it becomes much enlarged, and then assumes a variety of shapes, and thus modifies to a considerable extent the form of the flower.

THALLIUM, *thal'-le-um* (Gr., *thalos*, a green bough).—A metal, discovered in March, 1861, by W. Crookes, F.R.S., in some seleniferous deposit from the Silkerode sulphuric acid works on the Harz Mountains. Since then it has been found in the flue deposits of many other sulphuric acid factories where pyrites are used, in this country and on the continent. It is a heavy metal, having a specific gravity of 11.9, or rather higher than that of lead. It has a high metallic lustre when freshly scraped, but oxidizes readily in the air. It is the softest metal known, admitting of a free exposure to the air, being easily scratched by soft lead. In the spectroscope, this metal gives a single green line of great brilliancy; hence the name bestowed on it by Crookes, in allusion to its having been first detected by him through this means.

THEINE. (*See* CAFFEINE.)

THEOBROMA, *the-o-bro'-ma* (Gr., *theos*, a god; *broma*, fruit; from the delicious quality of its fruit).—A genus of the natural order *Byttneriaceæ*. *T. cacao*, the cacao or cocoa-tree, is a native of Mexico, and is now more or less extensively grown throughout Central America, Brazil, Peru, Venezuela, Caraccas, Ecuador, Grenada, Demerara, Essequibo, Guayaquil, and Surinam, with some of the West-India islands, foremost among which stands Trinidad.

THERAPEUTICS, *ther-a-pew'-tiks* (Gr., *therapeuo*, I attend the sick).—That department of medical science which deals with the way of curing disease. It treats of the symptoms of disease and the conclusions to be drawn from them; of the power of nature, and how far it may be relied on; of the modes of operation of the various remedies, &c.

THERMODYNAMICS, *ther'-mo-di-nam'-iks*.—That branch of physical science which refers to heat as a mechanical agent. (*See* HEAT.)

THERMO-ELECTRICITY. (*See* ELECTRICITY.)

THIGH, *thi* (Sax. *thegh*, Lat. *femur*).—That part of the upper extremity between the lower part of the trunk and the leg. It is articulated to the pelvis, and to the bones of the leg at the knee. The thigh-bone is the longest of all the bones of the body, and consists of a body or shaft and two extremities. This bone is well covered with muscles, and through the thigh pass large blood-vessels and nerves connected with the foot and leg. (*See* ANATOMY.)

THIRST, *thirst* (Sax. *thurst*).—That peculiar sensation which attends the desire to drink. During the operations of the animal functions a great quantity of moisture is consumed, the loss of which must be supplied; and thirst is the voice of nature calling upon the animal to supply the place of the lost moisture by drinking. The sensation of dryness of the mouth and throat, which most strongly characterizes thirst, is not always the result of these parts being actually deficient in moisture, nor is it removed by supplying the mouth alone with fluid. An outward application of moisture is found to diminish thirst; and sailors have been able to sustain life by bathing in the sea. Thirst is a sensation much more difficult to bear than hunger, leading from restlessness to anxiety, despair and madness.

THISTLE, *this'-l*.—The common name of plants of the genus *Cnicus*. They are herbs, with perennial roots, and sessile divided leaves, often much divided and prickly. The ordinary colour of the flowers, which are in many cases very large, is purple, but in some species yellowish or cream-coloured. The Common thistle (*C. lanceolatus*), the national emblem of Scotland, is a showy plant, attaining a height of three or four feet. It is frequently known as the spear thistle. The Creeping thistle (*C. arvensis*) is a perennial, spreading rapidly and extensively by its long root stocks. It is regarded as one of "the greatest pests of the fields." The deep roots lie below the reach of the plough, and its abundant seeds furnish it with ample means of spreading; besides which, the creeping rootstock is very tenacious of life, and when broken, every fragment is capable of forming a new plant. One species, the Tall thistle (*C. albissemus*), growing in the Southern States of North America, is a showy plant, often 10 feet high.

THORAX, *tho'-raks* (Gr., from *thoreo*, I leap, because the heart leaps in it).—The chest, or that part of the body which is situated between the neck and the abdomen. It is composed of bones, cartilages, and ligaments, which form a large conical cavity for the lodgment of the heart, lungs, and large blood-vessels. Its walls are formed posteriorly by the dorso-thoracic vertebræ and the ribs as far outwards as their angles, laterally by the bodies of the ribs, and anteriorly by the anterior extremities of the ribs, the sternum, and the costal cartilages. It is separated from the abdomen below by the diaphragm.

THORN.—A name given in combination for various spinescent plants, but by itself restricted to a species of the genus *Cratægus*, of the rose family, which belong to that division of the family (like *Pomea*), which includes the Apple-tree, &c. The Hawthorn, or White-thorn, or May-tree is well known in this country. (*See* CRATÆGUS.)

THORN-APPLE. (*See* DATURA.)

THORNBACK.—A species (*Raia clavata*) of Ray, common off the coast of Britain. The name is taken from a row of spines along the back and tail.

THREAD-WORM, OR FILARIA, *thred-wurm*.—A genus of worms belonging to the class *Entozoa*, order *Nematoda*, so called from their form, which is long and slender, resembling that of the Gordii among the annelida, but with mere marks on the body instead of rings. (*See* ENTOZOA.)

THRUSH, *thrush* (Sax., *thrise*).—A family of dentirostal birds (*Turdus*), of the order *Insessores*. Thrushes, or birds bearing considerable resemblance to thrushes, are found in almost every part of the world. Those which inhabit high latitudes, and places which are otherwise very seasonal in their character, are in general migratory, and those which inhabit places of more mild and uniform character are in general stationary. The generic characters are—beak of moderate size, straight, convex above; point of the upper mandible compressed, notched, and slightly curved downwards; the gape furnished with a few hairs, the nostrils oval, lateral, half concealed by a membrane; middle toe not so long as the tarsus, and the outer toes joined to it at the base. The number of species amounts to between 140 to 150, but we can only mention a few of them. The Missel thrush (*T. viscivorus*) is one of the largest of the European species, measuring eleven inches in length and about sixteen or seventeen in the stretch of its wings. It is resident in England all the year, and the male commences his song as early sometimes as February. It begins to build in April, and fixes its nest in the fork of a branch of a tree, frequently that of an apple-tree in an orchard. The eggs are of a greenish white, or sometimes of a reddish white colour, spotted with red-brown, and are four or five in number. The Song thrush (*T. musicus*) is "the thrush," by way of eminence, in England. In Scotland it is known as the "mavis." It is considerably smaller than the missel thrush. The length is about nine inches, the extent of the wings about thirteen and a half. The general colour above is brownish gray, and that below whitish red, mottled with dusky spots. It frequents small woods, plantations, and shrubberies, and seeks its food in meadows, lawns, and gardens. The eggs are usually four or five in number, of a beautiful light blue colour, with a few small well-defined black spots over the larger end. The song of the thrush is very sweet, and has considerable compass. The Solitary thrush (*T. solitarius*) has also been called the blue thrush from its colour. It inhabits the mountainous parts of the south of Europe. The general colour is blue, with gray margin to the feathers, the size rather smaller than the common blackbird, but the habits a good deal the same. The Rock thrush (*T. saxatilis*) frequents the wildest parts of rocky countries, and is found in summer on the Uralian Mountains, the Alps, and Pyrenees. It is a very shy bird, and makes its nest among fragments of rock or loose rough stones, of hair lined with moss. It is about seven inches and a half in length.

In Medicine, Thrush is a disease common to infants who are ill-fed, and consists of an eruption of small white or ash-coloured ulcers on the tongue and inside of the mouth, and not unfrequently extending to the throat and fauces. It is caused by irritation of the bowels, and is almost always attended with diarrhœa. It is rarely dangerous.

In Veterinary Surgery, acute inflammation of a horse's frog, which usually results in ulceration. Mineral tar is one of the most effective remedies.

THUJA, *thu'-ja* (Gr., *thuon*, a sacrifice).—The *Arbor Vitæ*, the resin of the Eastern variety of which is used instead of incense at sacrifices. Why it is called Arbor Vitæ is not known, unless it be on the supposed medicinal qualities of its berries. In this country the species of Arbor Vitæ can only be considered ornamental low shrubs or trees.

THUNDER, *thun'-der* (Ger., *Donner*).—The loud noise which is heard after a discharge of lightning from the clouds. The character of the sound of thunder is variable; sometimes it resembles the report of a single piece of ordnance, at other times it reverberates as if several large guns were being fired in succession, while at others it resembles the sound of file-firing in musketry.

Thunder-storm.—A storm accompanied by lightning and thunder. In all thunder-storms shelter should not be taken under trees or hedges, which will probably act as conductors; at the same time, however, a person is in greater safety at a distance of 30 or 40 feet from such objects than in an open plain. The safest position in a house is the middle of the room, and the security may be increased by sitting in a feather bed, a hair mattress, or a thick woollen rug, all of which are non-conductors. The most dangerous places are near the fireplace and in the cellar. Large metallic surfaces, gilt furniture, bell-wires, &c., all being conductors, should be avoided from the same reason.

THYLACINE, OR POUCHED WOLF, *thi'-la-seen*.—A marsupial animal of the *Daysurine* family, peculiar to Tasmania. Only one species is described, the Dog-headed Thylacine, about the size of a young wolf, with a tail 20 inches long. The fur is short and close, and rather woolly; the general colour is grayish-brown, with about a dozen transverse black bands on the back. It is wild and shy, dwelling in mountainous districts, and inactive during the daytime, but preying at night on the smaller marsupials. It is sometimes so large as to be a match for several dogs, and is one of the most formidable of Australasian quadrupeds. Fossil remains of similar animals have been found in New South Wales.

THYME, *time* (Gr., *thymos*, to burn perfume).—A low undershrub, or perennial herb, of the genus *Thymus*, of the Mint family. The garden thyme (*T. vulgaris*) was originally a native of Southern Europe, but is one of the most familiar culinary herbs used in this country, on account of its aromatic properties, due to an essential oil, oil of thyme, used in liniments, and as an external stimulant, especially in veterinary medicine.

THYMELACEÆ, *thim-e-lai'-se-e*.—The Mezereon family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*. Shrubs, or very rarely herbs. The plants of this order inhabit most parts of the world, but are especially abundant in Australia and the Cape of Good Hope. They are chiefly remarkable for the toughness and acridity of their bark. The fruit of *Dirca palustris* is narcotic, and that of the plants generally poisonous or suspicious.

TIBIA. (*See* LEG.)

TIC DOLOREUX, *tik dol-o-roo'* (Fr., painful spasm).—A very painful affection of a facial nerve. It comes on in sudden and excruciating attacks, attended with convulsive twitchings of the muscles, and continues from a few minutes to several hours. (*See* NEURALGIA.)

TICKS, *tiks*.—A species of minute animals (*Ixiodidæ*) of a parasitical nature, belonging to the general division *Acaridæ*. (*See* ENTOZOA and MITE.)

TIDES, *tidez* (Ang.-Sax.).—The alternate rising and falling of the waters of the ocean which is to be observed on all its coasts and estuaries. The rising is designated as the flood, and the highest elevation as high water; the falling is termed the ebb, and the lowest depression low water. The duration of high and low water without apparent change of level is known as the stand; and the cessation of the ebb and flood streams, or tidal currents, is called slack water. The tides depend upon the attraction of the moon, strengthened by that of the sun, according to the relative position of these two bodies. The ocean rises, or flows, as it is called, gradually, about six hours; it remains stationary about a quarter of an hour, it then retires or ebbs during another six hours, to flow again after a brief repose. In order to understand this, we must be familiar with the fact that all the heavenly bodies exercise, within certain limits, an attractive force on each other, greater in proportion to bulk, but limited by distance and by counter-attractions. Thus, although very much smaller than the sun, the influence of the moon on the earth is greater by reason of its proximity. The rise of the tide, or high water, at any particular part of the earth's surface is caused by the point in question being in the direct line of the lunar attraction, or of the moon's meridian—that is, the meridian of the earth which the moon at that time is apparently crossing. As the earth revolves daily on its axis, every part of the globe is brought every twelve hours, or thereabouts, to the moon's meridian, and there is high water. In consequence of greater distance, the attraction of the sun is only about one-third of that of the moon. But the two attractions sometimes act together, and then high or spring tides are the results; and sometimes in opposition, and then there are low or neap tides. The tides in rivers are caused by the influx of sea-water driving back the water of the stream. Lakes have no tides, owing to their dimensions being so small that the moon's attraction is equal on every part; and narrow seas, as the Mediterranean and the Baltic, undergo very slight changes of level from the same reason, and because their entrances are so contracted that they cannot receive a sufficient efflux from the tidal waves of the outlying oceans to raise their surface perceptibly.

TIGER, *ti'-ger* (Lat., *tigris*).—An animal (*Felis tigris*) considered to be a distinctive type of the family *Felidæ*. It is a most ferocious and bloodthirsty animal. There is only one species, and that is termed the Royal tiger. His colour is principally of a bright orange; his throat, face, and under portion of the body nearly white; and the whole surface of his coat banded with transverse stripes of a jet-black colour. His average length is about eight or nine feet, while his height from the ground is between three or four feet. Some specimens have occurred of much larger size; but these dimensions may be taken as the average size of the generality of the animals. In strength and activity the tiger exhibits the most stupendous powers. The distance he clears in his bound, and the wonderful celerity with which he accomplishes it, is marvellous, and hardly any beast, even the elephant, can resist the impetus of his attack. He can carry off a man with ease in his mouth, and has been seen to drag away a large buffalo apparently without effort. Tigers are not found on the African continent, but they abound in India, and are found in China and Sumatra. In India, however, the largest varieties are found; and there, as well as in Sumatra, the superstitious natives worship him through fear. In India, hunting the tiger is a very popular sport, and has done much good, by partially getting rid of the animal; for as the European dominion has become extended, the race of tigers has as proportionately decreased. The sport is carried on principally by hunters mounted on elephants, as no horse will face the tiger, even on coercion.

Tiger-Beetles.—A genus and family (*Cicindela*, or *Cicindelidæ*) of coleopterous insects, remarkable for their rapid and vigorous flight. They are generally found in dry meadows, sandy plains or heaths, and on the banks of rivers. The common green tiger-beetle is a very beautiful insect, being, as its name implies, of a bright grass-green colour, having five small round cream-coloured spots to mark the elytra, black and prominent eyes, with head, thorax, and limbs, which are long and slender, of a rich gilded cast.

Tiger-Cat.—A name commonly applied to several small species of *Felinæ*, in Asia, Africa, and America, especially to those marked with stripes. The largest and most handsome of all the varieties to which the name is given is the Rimau-dahan (*Felis macrocelis*), a native of Sumatra, known also as the Tree-tiger, from its living much in the branches of trees. It is not very common and not dangerous. It is about 3 feet long, with a tail nearly as long as the body, and 16 inches high at the shoulders, with soft and thick fur, brownish-gray in colour, with black spots and bands along the back. It feeds chiefly on birds and the smaller deer, &c.

Tiger-Flower.—A Mexican genus of bulb-bearing plants, belonging to the Iris family, and taking its name from the spotted flowers. One species, *Tigridia pavonia*, has rich scarlet flowers, variegated with bright yellow and spotted with black. Another species, *T. conchiflora*, has orange and yellow flowers with black spots. The flowers are 5 or 6 inches in diameter.

Tiger-Moth.—The type of the *Arctiidæ*, a family of nocturnal insects belonging to the order *Lepidoptera*. The common tiger-moth (*Arctia Caja*) is a very beautiful insect, measuring about three inches across the expanse of its fore wings, which are of a rich brown colour, with numerous irregular strokes and spots of creamy white; while the hind wings are of less size, and are diffused with bluish-black spots. The larvæ of these insects are covered with thick long hair, and present a most peculiar appearance. The *Arctia chrysorrha* is another variety, and its larvæ are very destructive to trees, particularly fruit-trees.

TILIACEÆ, *til-e-ai'-se-e.*—The Lime or Linden family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*. There are 38 genera and 350 species. A few are found in the northern parts of the world, where they form large trees (*see* LIME TREE); but the majority are tropical herbs, shrubs, or trees.

TILLANDSIA, *til-land'-se-a.*—A genus of the natural order *Bromeliaceæ*. *T. usneoides*, the tree-beard or old man's beard, appears as a mass of dark-coloured fibres hanging from the tree on which it grows. It is a common plant in South American forests. These hanging fibres form the article known in commerce as Spanish moss, and are employed for stuffing cushions, bird-skins, &c.

TIME, *time* (Sax., *tim*, Lat., *tempus*).—The general relation in which all things perceptible stand to each other in regard to their origin, continuance, and dissolution. It is a form necessary to enable the mind to unite successive periods of existence. In order to measure the succession and duration of particular things and events, the great motions of the heavenly bodies, which always remain the same, particularly of those bodies which are most closely connected with the earth, have been taken as standards; hence the physical or astronomical time. Such a measure of time is afforded by nature herself in the rotation of the earth on its axis. This gives rise to the sidereal time; but as the sidereal time will not serve for the purposes of common life, it was necessary to resort to the solar time. The latter, indeed, is unequal, and neither agrees with the sidereal time nor with that indicated by a clock; but this evil is remedied by the equation of time, through which the true solar time is changed into mean time.

TIN.—A white, malleable, easily fusible metal, not much affected by exposure to dry or moist air at ordinary temperatures, but becoming oxidized superficially when heated, burning with a brilliant flame if the temperature be raised sufficiently high. It is softer than gold and harder than lead, malleable into thin laminæ (tinfoil), and so ductile that it can be drawn into fine flexible wire. Native metallic tin is one of the rarest of metals; but ore from which tin is extracted is very common. It is found in quartzous crystalline rocks, and is associated with arsenical iron and copper pyrites, bismuth and other metals and feldspar, tourmaline and various earthy minerals. The leading localities where such deposits have been worked are Cornwall and some parts of Saxony and Bohemia; but they exist in other parts of the world. Extensive deposits of tin ore have recently been discovered in Tasmania.

TINAMIDÆ, *tin-a-mi'-de.*—A family of gallinaceous birds peculiar to South America. The Great tinamore is about 15 inches long, of a deep olive colour, slightly banded with black. It is found in Guiana and Brazil, and resembles in size, habits, and quality of flesh the English partridge.

TINEA, *tin'-e-a.*—A genus of moths, including the well-known clothes moth.

TISSUE, *tis'-shoo* (Lat.).—In Anatomy, texture, or organization of parts. The peculiar intimate structure of a part is called its tissue. A part of a fibrous structure is called a fibrous tissue. The organs of the body are made up of simpler elements, some generally diffused through the body, and others peculiar to particular organs. These simpler structures are called the tissues of the body, as the cellular tissue, the mucous tissue, &c. The cellular tissue is the cellular membrane.

TISSUE, ADIPOSE. (*See* ADIPOSE TISSUE.)

TISSUE, EPIDERMAL. (*See* EPIDERMAL TISSUE.)

TISSUES, *tis'-shooz.*—In Botany, compound structures formed by the combination of different kinds of cells. The principal tissues may be classed under two heads—namely, *Parenchyma*, or *cellular tissue*, and *Prosenchyma*, or *woody tissue*. Tissues of the former class constitute the entire structure of the lower plants, as *Algæ*, *Fungi*, and *Lichens*. The higher plants are made up of tissues of both classes.

TITANIUM, *ti-tai'-ne-um.*—A metal occurring in the somewhat rare minerals rutile, anaton, brookite, and titanic iron. The first three consist almost entirely of the binoxide of titanium or titanic acid. This metal is largely diffused throughout nature in most clays. In many respects it is a very singular metal. Its affinity for nitrogen is extraordinary.

TITLARK, *tit'-lark.*—The popular name of birds belonging to the *Motacelidæ* family, and evidently intermediate between the larks and the wagtails, resembling the former in their markings, and the latter in their movements and habits on the ground.

TITS, TITMICE.—A sub-family of birds belonging to the dentirostal tribe of the order *Passeres* and family *Luscinidæ*. They are distinguished by short conical bills, which have their tips entire, and their base covered with a few short stiff bristles. The wings are short and the tail long; the tarsi rather long and thick; the inner toe the shortest; and all the toes furnished with strong curved claws. The titmice are active little birds, and are commonly known in England under the names of tits, titmice, and tomtits, and many are distinguished for the beautiful colour of their plumage. They inhabit principally countries abundant in wood, and they feed on the insects and larvæ which they find on the bark and leaves of trees and shrubs. There are seven species known in Great Britain, of which the largest is the Great tit (*Parus major*), which is about five inches in length. It frequents houses, and is said to be very mischievous to thatched houses, as it pulls out the straw in pursuit of insects and grain. It is also said to kill birds even bigger than itself, in order to feed on their brains, which it obtains by splitting their skulls by repeated strokes of its own little beak. The Blue tit (*Parus cœruleus*) is another variety, and is so termed from the colour of its plumage. Besides these, there are the Crested tit (*P. cristatus*), the Coal tit (*P. ater*), the Marsh tit (*P. palustris*).

TOAD, *toad* (Sax., *tade*).—A tailless Batrachian reptile, belonging to the genus *Bufo*. It is harmless, and resembles the frog, but is less active. The frog leaps, the toad crawls. The toad feeds upon insects, flies, ants, &c.; it is preyed upon by owls, buzzards, snakes, &c. The toad attains to a considerable age, some remarkable instances of which have been recorded. (*See* FROG.)

TOAD-FISH.—A spiny-rayed fish of the *Lophius* family. This popular name has been given on account of its large head, wide gape, and generally unpleasant appearance. It is also known as the frog-fish and the oyster fish. Varieties are found in India and in America; the former is known as the grunting toad-fish from the noise it makes. It varies from 8 to 13 inches in length. The American toad-fish is found from Maine to the Gulf of Mexico and the West Indies, commonly in ponds and lagoons connected with the sea.

TOAD-FLAX.—A genus (*Linaria*) of herbs of the natural order *Scrophulariaceæ*. There are about 100 species, natives of Europe, western Asia, and North America. The Common toad-flax of Britain (*L. Vulgare*) has yellow flowers. It is purgative and diuretic.

TOBACCO, *to-bak'-ko*.—The common name of the plants comprised in the monopetalous genus *Nicotiana*, belonging to the *Solanaceæ* or Nightshade family. There are about 50 species. The term tobacco was, some writers assert, used by the Carribbees to designate the pipe in which they smoked it; which term having been transferred by the Spaniards from the pipe to the herb itself, has been adopted by other countries. Other accounts say that the name is derived from the province of Tabaca in St. Domingo, whence it was introduced into Europe in 1559 by a Spanish grandee. Afterwards, through the agency of Jean Nicot, French ambassador at Lisbon, it was taken to Paris, where, in the form of a powder, it was used by Catherine de Medici. It was some time after the use of tobacco as snuff that the smoking of it began. It is generally believed that tobacco was introduced into England by Sir Walter Raleigh and his companions after their return, in 1586, from their unsuccessful attempt to colonize Virginia. Very shortly after its appearance in the Old World, the herb was prohibited in England and many other parts of Europe. The physicians declared it hurtful to health, the priests denounced its use as sinful. Pope Urban VIII. issued a bull excommunicating all persons found taking snuff whilst in church. Sultan Amaruth made smoking a capital offence; whilst the penalty paid for smoking in Russia was to have the nose cut off. The strenuous way in which it was opposed by James I. of England is a matter of curious history. Without the consent of his Parliament, he raised the duty on the weed from 2d. to 6s. 10d. per pound: and his famous "Counterblaste to Tobacco" declared smoking "loathesome to the eye, hurtful to the nose, harmful to the brain, dangerous to the lungs, and in the black stinking fume thereof nearest resembling the horrible Stygian smoke of the pit that is bottomless." But kingly and priestly wrath were futile against the far and wide extension of the use of the herb, and at the present day it has become perhaps the most generally diffused luxury in existence.

TOMATO. (*See* LYCOPERSICON.)

TONGUE, *tung* (Sax., *tung*).—An organ found in most animals. The human tongue is a soft fleshy viscous, situated interiorly in the cavity of the mouth, very movable in every direction, and constituting the organ of taste (which *see*). Its movements are chiefly subservient to speech and the prehension and swallowing of food; and besides taste, it is also highly endowed with the sensation of touch. The sensitive power of the tongue resides in the membrane which covers it, the motor power in the interior. Indeed almost the entire substance of the tongue is composed of muscular fibres running in different but determinate directions, many of which belong to muscles which enter at its base and under-surface, and attach it to other parts. Hence the great variety and regularity of its movements, and its numerous changes of form. Between the several layers and bundles of muscular fibres, there is always found a considerable quantity of soft fatty tissue, and also a very fine areolar web. It is abundantly supplied with arteries, veins, and nerves. The upper surface of the tongue is covered all over with numerous projections or eminences named papillæ. Towards the tip and free borders they gradually become smaller, and disappear on the under surface. These are doubtless chiefly concerned in the special sense of taste, but they also possess in a very high degree that of touch.

TONQUIN BEAN. (*See* DIPTERYX.)

TONSILS, *ton'-silz* (Lat., *tonsillæ*).—Two complex glands, situated one on each side of the fauces, between the anterior and posterior arches of the soft palate. In relation to the surface of the neck, the tonsils correspond to the angles of the lower jaw, where they may be felt beneath the skin when they are enlarged. They are of an elongated oval form, usually about half an inch in length, and rather less in width and thickness, but they vary much in size in different individuals. Each is composed of a number of smaller glands, and presents a number of orifices opening on the surface of the mucous membrane. The nature of the secreted fluid is not certainly known, but it bears a general resemblance to saliva, and doubtless serves a similar purpose. The tonsils are largely supplied with blood-vessels and nerves. Sometimes they attain an undue size, and then excision is a necessary operation. Acute inflammation of the tonsil is known as quinsy.

TOPAZ, *to'-paz*.—A precious stone, a silico-fluoride of alumina, generally colourless, but in some cases blue, green, or red. It is chiefly found in the Ural and Altain Mountains, and in Kamschatka, in Asia, some parts of Saxony, the Mourne Mountains in Ireland, and in Brazil and in the American States, Connecticut and North Carolina. The topaz is not very highly valued as a gem, though fine specimens sometimes bring very good prices.

TORPEDO, OR ELECTRIC RAY, *tor-pe'-do*.—A fish (*Torpedo gymnotus*) belonging to the *Raiidæ*, or Ray family, a genus of fishes belonging to the order *Chondropterygii*, or cartilaginous fishes, the characteristics of which are given under a former article. (*See* RAY.) The name of this fish is derived from the Latin, and signifies a numbness or torpor, and was given in consequence of the electric shock which the fish diffuses through any one who touches it. The torpedo inhabits the Mediterranean and other European seas, and is not unfrequently found on our coast, especially on sandy bottoms, in which it buries itself by the flapping of its tail and fins. The torpedo is a flat fish, and it is sometimes mistaken for the skate by many people, who are much discomforted on touching it. The electrical apparatus with which this creature is endowed is formed of two organs lodged on either side of the head, and encompassed by the gills and the anterior border of the pectoral fins. Cuvier describes these organs as composed of little membranous tubes, placed close to each other, like a honey-comb, and subdivided into minute cells, abundantly supplied with nerves, which branch off in all directions. Each organ is about five or six inches in length, and three or four inches in breadth. All the perpendicular columns of which they are composed pass through the fish from the upper to the under surface of the body. It has been ascertained that the power of this fish is of a purely electrical character. Forty or fifty shocks have been given in this way by the torpedo in the space of about two minutes, each shock being produced by an evident effort on the part of the fish, with marked depression of the eyes, which sank in their orbits as the shock was given, though at other times they were prominent enough.

TORREYA, *tor-ray'-a.*—A genus of evergreen coniferous trees, named in honour of Dr. Torrey. It was first known to botanists in Florida ; but trees of an allied species grow in Japan. The Florida species, *T. Taxifolia*, attains an average height of about 30 feet; and resembles in general apearance the common hemlock spruce. In Japan, the oil of the tree (*T. nucifera*) is cultivated for the sake of the oil obtained from its seeds.

TORSK, OR TUSK.—A fish of the family *Gadidæ*, characterized by a single long dorsal fin. The fish, very abundant in the North Atlantic, averages about 2 feet in length. Its flesh is much esteemed when salted.

TORTOISE, *tor'-tus.*—The popular name of a reptile belonging to the family *Testudinidæ*, and order *Chelonia*, a genus belonging to the section *Cataphracta*, or shielded animals. The shell of the tortoise is solid, thick, and covered, in the adult state, with horny studs. The feet are short, stout, and somewhat clubbed, and the toes are almost entirely concealed under the skin, and are terminated by bent nails, of which there are generally five upon each of the anterior and four upon each of the posterior feet. In form, the head is rather small, and is covered with studs, and the jaws are horny, and are destitute of lips. The head, limbs, and tail can be completely retracted within the cavity of the shell. Most of the species are inhabitants of warm climates, and those which do exist in colder regions always burrow in the ground, and remain in a lethargic state during the winter. In habits, the tortoise is a great cumbersome animal, and is remarkable for its longevity and tenacity of life. Its food is purely vegetable, and its movements slow and awkward in the extreme. It is a terrestrial animal, although some species live when immersed in the water. The common tortoise (*Testudo græca*) is a native of the south of Europe, although it is found more abundantly in Greece than in any other parts of the Mediterranean. It is from six to eight inches long, and weighs about three pounds. The largest variety is the Indian tortoise (*Testudo Indica*), which often attains a length of three feet. It is a native of India and is very abundant in the Galapagos Islands. The flesh of the Indian tortoise is said to be very delicate, and the natives employ it largely, both salted and when fresh. A very thin oil is likewise obtained from its fat. A gigantic fossil species has been discovered in India in the tertiary formation. It has been termed the *Colossochelys Atlas*, and measured probably about sixteen feet in length.

TOUCAN, *too'-kan.*—A name given to a species of birds of the family *Ramphastidæ*, from the Brazilian imitation of their note. The family is remarkable for the disproportionate size of the bill, which is very light on account of its spongy texture. It is commonly marked with bright colours. These birds are peculiar to tropical America, living in flocks in the forests, where they make a great chattering as they hop from branch to branch in search of food. They are generally very handsome birds. The Toco toucan, inhabiting Guiana and Brazil, is 17 inches long, and the bill is more than half that length. The plumage is black with a white throat, and the bill orange-red with black tip. The Yellow-breasted toucan has a yellow throat, with red spot on the breast, the rest of the plumage being black. The Yellow toucan, the under surface of the body being of that colour, is found in the upper Amazon.

TOUCH, *tutsh.*—The sense of touch is not confined to any particular part of the body, like the other senses, but, on the contrary, exists in all parts capable of perceiving the presence of a stimulus by ordinary sensation. It is, in fact, a modification or exaltation of common sensation or sensibility. It properly belongs to the outward covering of the body, the skin, but is also shared, in a minor and modified degree, by parts of the mucous membranes, which are, indeed, continuous prolongations of the same substance. There are certain parts in which the sense of touch is much more acute than others; as the tongue, lips, hand, soles of the feet, &c. These are more abundantly than other parts studded with numerous papillæ, on which this sense mainly depends. Each papilla is abundantly supplied with blood, and also contains one or more terminal nerve-fibres, on which its exquisite sensibility depends. The papillæ do not come into direct contact with external objects, but, like the rest of the surface of the skin, are covered with one or more layers of epithelium, forming the cuticle or epidermis. By the sense of touch the mind is made acquainted with the size, form, and other external characters of bodies. Touch may be greatly improved when the other senses are impaired or lost, partly from the greater attention given to the sensations and the consequent increase of the powers of discrimination. This is remarkably exhibited in the case of blind persons.

TOURACA. (*See* HOAZIN.)

TOURMALINE, *toor'-ma-leen.*—A name

applied to a group of rhombohedral double silicates, composed of silica, fluorine, boric acid, alumina, manganic, ferric and ferrous oxides, magnesia, lime, soda, potash, and lithia. The colour of tourmalines varies with their composition; the rarest are white. Tourmaline is usually found in granite, gneiss, various schists, dolomite, granular limestone, and sometimes in sandstone near igneous rocks.

TOXICOLOGY. (*See* POISONS.)

TOXODON, *tox'-o-don* (Gr., *toxon*, a bow, and *odons*, a tooth).—A name given by geologists to a genus of extinct mammals of the order of *Congulates*, with affinities to edentates and rodents. The first specimen found was in miocene clay in South America. It was large and low on the legs, and probably aquatic. The name was given from the curve of some of the teeth.

TRACHEA, *trak'-ke-a* (Gr., *tracheia*, the windpipe).—The cartilaginous and membranous canal through which the air passes into the lungs, commonly known as the windpipe. Its upper part is called the larynx, the uppermost and smallest part of which is called the epiglottis, being placed over the glottis, or mouth of the larynx, and serving to close the passage to the lungs in the act of swallowing. (*See* LARYNX.) From the lower end of the larynx the canal takes the name of trachea, or aspera arteria, and extends as far down as the fourth or fifth vertebra of the back, where it divides into two branches, which are the right and left bronchial tubes. Like the larynx, it is formed of cartilages, united to each other by means of very elastic ligamentous fibres. It is also furnished with fleshy or muscular fibres, and is supplied with a great number of small glands, which discharge a mucous fluid on its inner surface.

TRACHYTE, *trak'-ite* (Gr., *traxus*, rough).—A rock of volcanic origin, consisting chiefly of glassy felspar, sometimes associated with hornblende and augite. The name indicates the roughness of the surface.

TRADE WINDS. (*See* PHYSICAL GEOGRAPHY and WIND.)

TRAGACANTH. (*See* ASTRAGALUS.)

TRAGOPOGON, *tra-gop'-o-gon* (Gr., goat's-beard).—A genus of the natural order *Compositæ*. The roots of *T. porrifolius*, the salsify, or oyster-plant, are eaten.

TRAJECTORY, *traj-ek'-to-re.*—That curve which a body describes in space when projected. When applied to rifle-shooting, it indicates the course of the bullet, which, instead of being straight, forms a complete curve, which increases more and more in proportion as the distance from the muzzle increases.

TRANCE.—A condition of insensibility, with the appearance of sleep, but sometimes extending over a long period. It is an old idea that, during a trance, the soul leaves the body, which, however, does not exhibit any signs of decomposition, as in the case of death.

TRANSCENDENTAL QUANTITIES, *tran-sen-den'-tal.*—In Mathematics, those quantities which cannot be expressed by a finite number of algebraic terms, but are represented by means of logarithms or variable experiments. *Transcendental curves* are those equations which express a relation between transcendental quantities.

TRANSFUSION OF BLOOD.—The operation of introducing into the vascular system of one animal blood taken from the vessels of another. It was first successfully practised in England in 1665, and has occasionally been resorted to with success in cases where the vital powers of the patient appear to be failing.

TRANSIT, *tran'-zit* (from Lat.).—The culmination or passage of any celestial body across the meridian of an observer. The determinations of the exact times of such transits is one of the most important operations of practical astronomy. (*See* TRANSIT CIRCLE.) The term transit is also applied when Venus or Mercury, in their revolution round the sun, pass between the sun and the eye of the observer on the earth, and appear to move like black spots over the sun's disc. If this phenomenon be noted by different observers at points considerably distant from one another, it will not be of equal duration at all these points; and since the difference of time depends on the parallax of the planet, as well as of the sun, the latter can be estimated by means of the former.

TRANSPIRATION, *tranz-pi-rai'-shun* (Lat., *trans*, through; and *spiro*, I breathe).—The diffusion of liquids, vapours, and gases through a capillary tube. The transpiration of liquids was first examined by Poiseville, but little was discovered beyond the fact that when different liquids were pressed through tubes of equal size, with identical forces, the times of the passage of similar quantities differed considerably, but no connection could be traced between these differences. Graham has, however, made a series of experiments on the transpiration times of certain acids, salts, and other substances, in different stages of dilution, and arrived at definite results.

TRAP (Swedish, *trappa*, a stair).—A class of volcanic rocks, so named because of the stair-like appearance they often present. (*See* GEOLOGY.)

TRAPA, *trap'-a.*—A genus of floating aquatic plants, belonging to the natural order *Haloragiaceæ*, remarkable for their horned fruit and large amygdaloid edible seeds. *T. natans* is the *Marron d'eau*, or water chestnut; *T. bicornis* is the Chinese ling; *T. bispinosa* is the Singhara nut of Cashmere.

TRAPEZIUM, *tra-pe'-ze-um.*—In Geometry, a quadrilateral, no two of the sides of which are parallel.

TREES, AGE OF. (*See* AGE OF TREES).

TREES, CULTURE OF. (*See* ARBORICULTURE.)

TREMANDRACEÆ, *tre-man-drai'-se-e.*—The Porewort family, a small natural order of *Dicotyledones*, sub-class *Thalamifloræ*. They are slender heath-like plants, all natives of New Holland.

TREE FROG.—Batrachian reptiles of the family *Hyladæ*, distinguished from the common frog by having the ends of the fingers and toes dilated into flattened discs, or suckers, which enables them to lead an arboreal life. They possess a remarkable power of changing colour, which enables them to elude their numerous enemies. The species are numerous, especially in America. Only one is found in Europe, and that also occurs in Northern Africa and Asia. The common tree-frog (*H. versicolor*) is about two inches long. The Flying tree-frog of Borneo (*Rhacopherus*) is an extraordinary creature, having very large toes fully webbed to their extremities. By expanding these webs and inflating its body it is able to use them as a sailing membrane in its descent from high trees. It is four inches in length. The upper part of the body is of a deep green colour, and the lower part yellow.

TREFOIL, *tre'-foil.* (*See* CLOVER.)

TRIANGLE, *tri-ang'-l.*—In Geometry, a figure bounded by three sides, and therefore possessing three angles. An *equilateral* triangle has all its sides equal; an *isosceles* triangle, two of its sides equal, and a *scalene* triangle, all the sides unequal. A *curvilinear* triangle has one or more sides curved.

TRIASSIC SYSTEM, *tri'-as-sik.*—A system which derives its name—*Trias*, or triple system—from its being composed, in Germany, where it is very fully developed, of three main members—viz., the *Keuper*, the *Muschelkalk*, and the *Bunter Sandstein*. These, as far as they may be compared, are the equivalents of the upper New Red Sandstone of England. (*See* GEOLOGY.)

TRICHINIASIS, *trik-i-ni-a'-sis.*—A fatal disease generally caused by eating raw or underdone pork, containing a minute worm, *Trichina spiralis*.

TRIFOLIUM, *tri-fo'-le-um* (Lat., *tres*, three; *folium*, leaf).—A genus of the natural order *Leguminosæ*. The species are the useful fodder plants known as clover.

TRIGONELLA, *trig-o-nel'-la* (diminutive of Lat., *trigon*, a triangular place, from its small triangular flower).—A genus of the natural order *Leguminosæ*. The seeds of the species *T. Fœnum græcum* are much used in veterinary medicine, under the name of *fenugreek*.

TRIGONOMETRY, *trig-o-nom'-e-tre* (Gr., *trigonos*, a triangle; *metron*, a measure).—That branch of mathematics which treats of measuring triangles. The exact meaning of the term, however, has been much extended; so that it includes the determination of the situation and distance of all the points in a given space, in which the distance and situation of some points are given. A plain triangle consists of six parts, namely, three sides and three angles; the numerical value of any of these parts being given, and one of these three being a *side*, the value of any of the other three may be found by trigonometry. Trigonometry is divided into plane and spherical. The science owes its origin to the Greek astronomers of Alexandria.

TRILLIUM, *tril'-le-um* (Lat., *trilix*, triple).—A genus of North American plants, belonging to the Lily family. They are perennial herbs; there are about 12 species, remarkable for the beauty of the flowers. The Gnat-flowered trillium (*T. grandiflorum*), is the showiest species, the large white flowers being in some cases three inches in diameter. They become rose-coloured with age. The roots of all the species contain an acrid principle, a valuable oil, resin and tannic acid.

TRILOBITE, *tri'-lo-bite* (Gr., *treis*, three, and *lobos*, lobe).—An extensive family of fossil palæozoic crustaceans, deriving their name from the obvious three-lobed-like aspect of their bodies. The trilobites, in numerous generic forms, as *asaphus*, *ampyx*, *calymene*, *homalonotus*, *illænus*, &c., are especially characteristic of the Silurian system. About a dozen genera range through the Devonian epoch; only three or four appear in carboniferous strata; and not a single specimen has been found in later formations.

TRIPE DE ROCHE. (*See* GYROPHORA.)

TRIPTOLOMÆA, *trip-to-lo'-me-a.*—A genus of the natural order *Leguminosæ*. The *rose-wood* of the cabinet-makers is obtained from several species of this genus, natives of South America.

TRITICUM, *trit'-e-kum* (Lat., wheat).—A genus of grasses (*Graminaceæ*). *T. vulgare* and its varieties supply the inhabitants of many civilized countries with their most important article of food. The cultivated varieties are very numerous.

TRITON, *tri'-ton.*—The proper name of the tailed batrachians generally called newts. The name is also given to a genus of gasteropod molluscs of the Murex family. The shell is conical, elongated, and spirally convoluted. The *T. variegatum* of the Indian seas, 12 to 14 inches long, is the sea trumpet of the Triton of mythology; and the Polynesians use it as a horn.

TRIURIDACEÆ, *tri-u-re-dai'-se-e.*—In Botany, a small natural order of *Monocotyledones*, sub-class *Petaloideæ*. Tropical plants closely allied to the *Naiadaceæ*.

TROCHILIDÆ. (*See* HUMMING-BIRDS.)

TROGLODYTES, *trog'-lo-dites* (Gr., *trogle*, a cave).—In Natural History, the name is applied to the chimpanzee and gorilla, and also to a genus of the wren family of birds.

TROGON, OR COUROUCOU, *tro'-gon, koo-roo-koo.*—Birds of the family *Trogonidæ*. The second name is derived from their peculiar melancholy cry. There are about 40 species in the tropical regions of both hemispheres, but especially numerous in the South American forests. The plumage is very brilliant, and the tail feathers of some of the species are of great length, not uncommonly three times that of the body. One of the larger species is the Red-bellied trogon of Mexico, which is about 12 inches long, green above red below, with a black throat and a tail striped with the same colour. The peacock, or splendid trogon, is still larger, and the middle tail feathers are in some cases more than three feet in length. It is found in Mexico and Central America, where the feathers of this and the preceding species are much prized for ornament.

TROOPIAL, *troop'-e-al.*—A name sometimes given to several species of American birds, in some respects resembling the starlings of the old world, and in others coming near the finches. They are generally known as Orioles (which *see*).

TROPÆOLACEÆ, *tro-pe-o-lai'-se-e.*—The Indian Cress family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*, smooth trailing or twining herbs. There are four genera and about forty species, chiefly natives of South

America. They are generally acrid, pungent, and antiscorbutic.

TROPÆOLUM, *tro-pe'-o-lum.*—The typical genus of the natural order *Tropæolaceæ*. *T. majus* is the showy Indian Cress or garden nasturtium—a well-known plant, with bright yellow flowers and smooth peltate leaves.

TROPICS, *trop'-iks* (Gr., *trope*, to turn).—In Astronomy, two circles parallel to the equator. That in the northern hemisphere is known as the tropic of Cancer, and that in the southern as the tropic of Capricorn. It is between the tropics that the sun's path is circumscribed. In Geography the tropics are the two parallels of latitude over which the sun is vertical at the solstices.

TROPIC BIRD. (*See* FRIGATE-BIRD.)

TROUT, *trowt* (Sax., *truht*).—The name applied to a family of fishes belonging to the subgenus *Salar*, of the family *Salmonidæ*. The common trout (*Salmo fario*) is a well-known fresh-water fish, which inhabits the rivers and lakes of Europe. It is a fish greatly prized by anglers, on account of its being very shy at taking bait, and being excellent for the table. Specimens have been taken more than two feet long, and exceeding fifteen pounds in weight. It deposits its ova in a hole or nest in the sand at the bottom of the river. It is a shorter and stouter fish than the salmon, and the colour of its back is a yellowish brown, its sides yellowish, tinged with bright red, which verges into a glossy white on the belly, giving it a very pretty appearance. The gray trout is in larger variety than the former, but its flesh is considerably inferior in quality. It is termed the *Salmo ferox*. (*See* also SALMON.)

TRUFFLE, *troof'-l.*—An underground fungus used as food. The best known belongs to the genus *Tuber*, while others which bear the name are of related, but different, genera.

TRUMPET FISH. (*See* PIPE FISH.)

TRUMPET FLOWER.—A popular name for *Tecoma radicuns*, and used with a prefix for other plants. It is a native of tropical America, a woody vine, climbing to a great height by abundant rootlets produced along the stem. It blooms in July and August, and the abundance of its orange and scarlet bloom makes it very showy. The Great-flowered trumpet flower, a native of China and Japan, does not grow so high as the American species, but the flowers are larger, bell-shaped, and three inches across. An Australian variety (*T. jasminoides*) has white flowers, with a purplish tinge in the lower part.

TRUNK FISH.—The name of some fishes of the genus *Ostracian*, derived from the bony case in which their soft parts are enclosed. They are also known as coffer-fishes. They are generally small, and found in the tropics.

TSETSE, *tset'-se.*—A poisonous fly of tropical Africa of the genus *Clossense*. It is a little larger than the common house-fly, with head of a buff colour and large eyes; the thorax is chestnut red, with longitudinal black bars; the abdomen is buff colour, with black spots. It is the scourge of the districts where it is found. The puncture of its proboscis is almost certain death to the ox, horse, sheep, and dog, but is harmless to man, producing only a slight itching. No remedy for the bite is known.

TUBER, *tu'-ber* (Lat.).—A subterranean branch arrested in its growth and excessively enlarged by the deposition of starch in its tissue. It has upon its surface a number of little buds, or eyes as they are commonly called, from which new plants are formed the succeeding year. The potato and Jerusalem artichoke are good illustrations of this peculiar modification of the stem. The term is also specially applied to the Truffle, a genus of *Fungi*. The species are subterranean, and dogs and pigs are trained to discover them by the smell. Truffles are highly esteemed as seasoning or flavouring agents. Several species are found in England, but the best are imported from France, Algeria, and Italy, preserved in oil. *T. æstivum*, *cibarium*, and *melanosporum* are the species commonly used. Truffles are generally found in calcareous soils, and in woods of oak and beech. The weight varies from two ounces to several pounds. There are white kinds, but generally the surface has a black or brown colour.

TUBEROSE, *tube'-rose.*—A plant (*Polianches tuberosa*) of the Amaryllis family, cultivated for its fragrant flowers. It is one of the most important of florists' plants. The flowers consist of a funnel-shaped, slightly curved tube, with six nearly equal spreading lobes, often tinged with rose-colour without and creamy white within, omitting a powerful fragrance.

TULIP, *tu'-lip.*—A genus of the natural order *Liliaceæ*. The species are few, but the varieties are endless, and are among the most beautiful bulbous plants. In the middle of the 17th century there was quite a mania for cultivating tulips in the Netherlands, and most extravagant sums were given for bulbs of new varieties. Tulip fanciers reckon several classes of the flower—those in which a white ground is broken with several shades of purple and other colours; those having a yellow ground, variegated with other colours; those with the flowers white at base, and broken with a rich brown; and those with cherry or rose-coloured ground, white bottoms, and marked with shining brown. Breeders are bulbs raised from seed, and are at first all of one colour; by continual cultivation, in course of time (sometimes extending over several years), they "break," or become variegated.

TULIP-TREE.—A popular name for *Liriodendron tulipufera*, a large tree of the magnalia family, noticeable for its large and showy flowers. It is the largest of American deciduous trees, reaching the height of about 140 feet. The wood is white, soft, and easily bent to any shape, and is consequently of value for building purposes, carriages and cabinet work.

TUMOUR, *tu'-mur* (Lat., *tumere*, to swell).—A term of Surgery, in its widest acceptation, denoting a swelling of any kind on any part of the body; but it is commonly restricted to a swelling of a permanent nature, while such as arise from inflammation and disappear along with the cause, are usually known as *tumefactions*. Tumours are commonly distinguished into *sarcomatous*, or such as are firm and of a fleshy consistence, and *encysted*, consisting of a sac containing matter more or less pulpy or fluid. Of each of these, surgeons distinguish several kinds.

TUNGSTEN, *tung'-sten* (Sw. & D., *tung*, heavy; and *sten*, stone).—A metal found in small quantities in the form of an acid in Scheelite or tungstate of lime, and wolfram, a tungstate of iron and manganese. The metal itself, which is of an iron-gray colour, is procured from the tungstate of lime. Its alloys are unimportant. The salts of this acid are valuable. This acid is readily procured in an impure condition, by heating Scheelite or wolfram with hydrochloric acid, which dissolves the metals, leaving the tungsten acid behind as an insoluble residue. The anhydrous acid is of a beautiful lemon-yellow colour, insoluble in water, but soluble in solutions of the alkalies, with which it forms soluble salts. The most important of these is the tungstate of soda, now extensively used as an antiflammable agent in starch. The tungstate of lead appears to offer decided advantages as a white pigment. Tungstic acid itself is of a fine yellow colour; tungstate of tungsten is blue, tungstate of tungsten and soda is saffron, with beautiful golden spangles distributed through its mass; tungstate of tungsten and potash is magenta, with the same crystalline appearance; and a mixture of the two last gives a very beautiful violet. With both chlorine and sulphur, tungsten forms two compounds corresponding to its oxides. Both the chlorides are volatile; an oxychloride, having the properties of an acid, may also be formed by passing dry chlorine over the heated binoxide.

TUNNY, *tun'-ne.*—A large fish of the Mackerel family. The common tunny of Europe is from 15 to 20 feet in length, and some specimens have been found to weigh over 1000 lbs. The colour is dark blue above; the lower part grayish white, with silvery spots; and the sides of the head white. Tunnies are very active and voracious. They are very abundant in the Mediterranean, approaching the shore in summer for the purpose of spawning. The flesh is as firm as that of the sturgeon, but more highly flavoured. The principal fisheries are on the coasts of Sicily and Sardinia. The American tunny, known also as the horse-mackerel and albicore, is from 10 to 12 feet in length. It is nearly black above, white below, and silvery on the sides. It is found from New York to Nova Scotia. It is taken by the harpoon, chiefly for the sake of the oil, about twenty gallons of which are yielded by a single fish.

TURBOT, *tur'-bot* (Fr.).—A fish (*Rhombus maximus*) belonging to the genus *Rhombus*, of the family *Pleuronectidæ* (Gr., "side-swimmers") of the order *Anacanthini*, or those which have no spines in the fins. The family are generally known by the name of flat-fish, and are rendered peculiar amongst vertebrated animals from the fact of both eyes being placed on one side of the head, which side is always uppermost when the fish is swimming. The body of the turbot is very compressed, and is of a brown colour, and beset with tubercles, which, indeed, seem to distinguish it from the brill, which otherwise it much resembles. The under surface of the body is white. The turbot is found generally in deep water along our coasts, and its flesh is much esteemed for the table; consequently its fishery is an object of much importance to the maritime population. It is caught by means of hooks and lines, and by trawl-nets during the warm months of the year. The brill is a smaller species. (*See* BRILL.)

TURKEY, *turk'-e.*—A genus of birds (*Meleagris*) belonging to the order *Gallinæ*, family *Phasianidæ*, and sub-family *Meleagridæ*. The type of the genus is the well-known Common Wild Turkey, *Meleagris gallopavo*, which has been proved to be of Mexican origin, and to be the true parent of our common domestic species. When full grown, the male wild turkey is nearly four feet in length, and about five feet in extent from wing to wing, while the colour of the feathers is of dark gray, and other colours, bordered on the edges with gold and similar vivid hues, presenting a splendour of plumage which we look in vain for in the domestic turkey. The domestic turkey, in this country, is a stupid heavy bird, and is so well known as hardly to call for any special description. The name of Turkey is said to have been given it from a mistaken opinion that it was a native of that country. The plumage is much inferior to that of the wild turkey, but by some authorities it is considered a handsome bird. Great numbers are reared in England, principally in Norfolk, whence large quantities reach the London market about Christmas time. A second species of the turkey is found in Honduras, termed the Ocellated turkey (*Meleagris ocellata*), which is much more brilliant in plumage than the common variety. It is nearly of the same size, but its feathers are of a beautiful metallic green, or bronze colour, variegated with black, gold, and azure-blue.

TURKEY BUZZARD.—The popular name of one of the common American vultures. It is about 2½ feet long, and 6 feet in extent of wing. The colour is brownish-black, with a purplish lustre, head and neck bright red, bill yellow. On the neck is a circular ruff of prominent feathers. It is found all over North America, except in the Arctic regions.

TURMERIC, *tur'-me-rik.*—The root-stocks of several species of *Curcuma* (which *see*), but applied especially to *C. longa* plants of the Ginger family. They are natives of Southern Asia. Long turmeric is two or three inches in length; round (or rather oval) turmeric is an inch thick, and two inches long. Both kinds are marked by transverse scars or wrinkles, and are externally of a yellowish colour. The odour resembles that of ginger, and the taste warm and aromatic. They form an orange-coloured powder, formerly employed in medicine as a tonic, but is now used only to colour ointments and other preparations, to colour varnishes, and as an ingredient in curry powder.

TURNERACEÆ, *tur-ner-ai'-se-e.*—A natural order of *Dicotyledones*, sub-class *Calyciflorœ*, consisting of herbaceous or shrubby plants, confined to South America and the West Indies. Some are said to be astringent, others tonic, and a few aromatic.

TURNIP.—A variety of *Brassica*, *Campestris.* (*See* BRASSICA.) There are two distinct classes, the common round, or English turnip; and these known as Swedes, with larger elongated and more solid roots. All are biennials; but as their roots are not perfectly hardy, they must be stored for the winter. The round turnip is a favourite vegetable for the table, especially as an acompaniment to boiled mutton, and afford excellent food for cattle and sheep; but the amount of nutritive matter is very small.

Turnip-fly, *tur'-nip.*—A well-known species (*Haltica nemorum*), of the *Galerucidæ*, a family of leaf-eating beetles. It is a very destructive insect, and is named from the great injury it inflicts on turnip fields, feeding on the interior of the leaves, where they take up their abode, and in fact undergo their transformation.

TURNSTONE, *turn'-stone.*—A wading bird of the Oyster catcher family. It takes its name from its turning over with its strong bill the stones along the margins of the sea and lakes and rivers in search of insects, molluscs, and crustaceans. The best known species is about 9 inches long. Brownish black and white are the prevailing colours, and the legs are orange. It is found all over the world.

TURTLE, *tur'-tl.*—A reptile similar to the tortoise, and belonging to the family *Cheloniidæ.* The body of the turtle is short, swollen, and inclosed in a case formed of two shields, united by their margins, and composed of a crust of imbedded plates, which leave the neck, limbs, head, and tail free. These parts are usually covered with a scaly skin. They have four legs, which are short and thick, and the tail is short and conical. They respire by means of lungs at all ages, and are viviparous; and their brain and senses are but very indifferently developed. These characteristics are shared by the tortoise as well; but in the turtles the limbs are connected with fin-like organs, as their habits are purely aquatic. The turtle feeds on grass, sea-weed, and other marine plants, and in some instances on small mollusca. The female produces her eggs about the month of April, to the number of one hundred or more, which she buries in the sand, where they soon become invigorated with life. As an article of food, the turtle is much prized, whereas the flesh of the tortoise is quite coarse and uneatable; and this constitutes another distinction between them. The best-known variety of the edible species of turtle is that termed the green turtle (*Chelonia viridis*), which is found in the seas of most warm climates, and of which large numbers are anually imported into Europe for the purposes of the table, no great banquet being considered complete without this dish making its appearance. This variety in some cases attains a length of five or six feet, and a weight of from five to six hundred pounds. The flesh of this turtle is peculiarly delicate, and the eggs are likewise esteemed a great dainty. The green turtle abounds in the West Indies, off the Bahamas, and at the island of Ascension, which latter place, in fact, seems to be their head quarters. They are also often met with in the Atlantic, sometimes seven hundred or eight hundred leagues from land, where they are easily captured when asleep on the surface of the water. The Hawk's-bill turtle (*Chelonia imbricata*) is another variety, which does not attain so large a size as the one just described, seldom being found to exceed two hundred pounds in weight. This variety is found in the Atlantic and also in the Indian Ocean, but it is not much thought of, as its flesh is very coarse and inferior to that of the green turtle. This turtle is much sought after for the value of its shell, which is converted into the best "tortoise-shell" of commerce. The largest species is termed the loggerhead turtle (*Chelonia caretta*), which is found in the Mediterranean Sea not unfrequently, besides the Atlantic and other tropical seas. This variety generally feeds on mollusca, and its flesh is unfit for food. Of these the *Tryonix ferox*, or snapping turtle, is one of the most remarkable, as it destroys large numbers of young alligators in North America annually. The flesh of the snapping turtle is superior to that of any other of the varieties of the turtle known, and on that account it is much hunted.

TURTLE DOVES.—A name commonly given to several varieties of small pigeons, smaller than the domestic pigeons. More than a dozen species are known in various parts of Europe, India, and Africa. The common European turtle-dove is eleven inches long; the head, neck, breast, and back, are brown, tinged with pearl-gray; a patch of black feathers margined with white is on each side of the neck; the lower parts and the tip of the tail feathers are white. It arrives in the temperate regions of Europe in May, leaving at the end of summer, but is a rare visitor to Great Britain. The Collared, the Cape, and the Carolina turtle-doves are other well-known varieties.

TUSSILAGO, *tus-sil-ai'-go* (Lat., *tussis*, a cough).—A genus of the natural order *Compositæ.* *T. Farfara* is the colt's-foot, an herb which has long been employed as a popular remedy in chronic cough and other pulmonary diseases.

TYPES, CHEMICAL.—The characteristics of substances which are supposed to have an analogous malecular construction, or are built up of elements which, although unlike, bear a certain relation to each other, by reason of which the materials of one part of the chemical fabric may be replaced by others, without altering the chemical structure.

TWILIGHT.—The faint light which appears in the sky a little before sunrise, and again for some time after sunset, the amount and duration of the light varying considerably in different latitudes and at different seasons. It is caused by the reflection of the sun's rays, when below the horizon, from the vapours and minute solid particles floating in the atmosphere.

TYPHACEÆ, *ti-fai'-se-e* (Gr., *tiphos*, a fern).—The Bulrush family, a natural order of *Monocotyledones*, sub-class *Petaloideæ*, consisting of herbs with rigid linear leaves and monœcious flowers, arranged on a spadix or in heads. They grow in watery places, chiefly in the northern parts of the world. The young shoots of *Typha latifolia* and *angustifolia* are sometimes boiled and eaten like asparagus. Their rhizomes are also edible.

TYPHOID FEVER, *ti-foyd'.*—A fever resembling in its main features typhus; and until very recently the two were generally regarded as but two stages of the same affection, but they are now recognized as essentially distinct disorders. Typhoid fever usually commences more insidiously and more gradually than typhus; the sufferer is less dull and stupid, but more anxious, and during the delirium decidedly more active, and even vivacious. Diarrhœa is almost always present in typhoid fever (often accompanied with hæmorrhage), very rarely in typhus. In the former the eruption consists of rose-coloured spots thinly scattered, and often entirely absent. Typhoid fever is most common in youth, and rarely attacks persons after forty, while typhus may occur at any age; and the former does not reach its height for a week later than the latter. Typhoid fever is endemic, and is frequently caused by defective drainage, and the consequent escape into houses of poisonous sewer gas.

TYPHOON, *ti'-foon.*—A hurricane of a very destructive character, experienced in the Chinese Seas.

TYPHUS, *ti'-fus* (Gr., *tupho*, I smoulder, or burn and smoke without vent).—A kind of continued fever, characterized by the ordinary symptoms of fever, with debility in the nervous and vascular systems, and a tendency in the fluids to putrefaction. It is so called because it burns not in open violence, as an inflammatory fever does, but with a sort of concealed and smothered flame. Any of the ordinary causes of fever may give rise to typhus. Cold, intemperance, mental agitation, &c., which, in strong and sanguineous habits might generate an inflammatory fever, will often in a debilitated and nervous constitution give rise to typhus. It is eminently contagious and infectious, and often prevails epidemically. It does not always commence in the same way, and sometimes it may be several days before the disease assumes its proper aspect, during which the patient may continue his ordinary occupation, but complaining of chilliness, nausea, thirst, loss of appetite, languor, and headache. Frequently, however, the precursory stage is short, or altogether wanting, and it commences with symptoms which are common to many acute diseases. Sometimes it sets in with a shivering fit or a severe headache, accompanied with great prostration and muscular pains in various parts. There are also dryness and heat of skin, thirst, constipation, and rapid pulse, with great irritability and restlessness towards the evening. Sometimes, even during the first stage of the disorder, the prostration of strength is so great that the patient lies on his back motionless, and insensible to all that is going on around him. Towards the end of the first week the eruption peculiar to typhus begins to show itself. It consists of irregular spots of a dusky or mulberry hue, disappearing on pressure, and feeling as if slightly raised above the skin. During the second week the pulse becomes more frequent, weaker, and more compressible, the tongue darker and browner, and the voluntary movements very much weakened. It is in the course of the second week that the disease is most apt to terminate fatally. During the third week the patient's chance of recovery improves; in which case the more formidable symptoms begin gradually to abate.

U.

ULCER, *ul'-ser* (Lat., *ulcus*).—A purulent solution or continuity of the soft parts of the body, either opening to the surface or any internal cavity, and attended with a secretion of pus or some kind of discharge. Ulcers may arise from a variety of causes, as from wounds, specific irritations of the absorbents, from cancer, scurvy, scrofulous virus, &c. The immediate cause of ulcers is an increased action of the absorbents, while at the same time the arteries by a specific action separate a fluid from the blood upon the ulcerated surface.

ULEX, *u'-lex.*—A genus of thorny shrubs of the *Leguminosæ*, popularly named furze and gorse. There are about a dozen species, natives of Europe and North Africa; two are found in Great Britain.

ULMUS, *ul'-mus* (Lat.).—The elm, the typical genus of the natural order *Ulmaceæ*. The species *U. campestris* is the common English elm; *U. montana*, the Scotch or Wych elm; and *U. fulva*, the Slippery elm of the United States. The timber of the first two species is not readily acted upon by water, and is on this account much valued for certain purposes. The inner bark of the slippery elm is employed in America as a demulcent for both internal and external use. When ground, it forms an excellent emollient poultice.

UMBELLIFERÆ, *um-bel-lif'-e-re* (Lat., *umbella*, an umbel; *fero*, I carry).—The Umbelliferous family, a natural order of *Dicotyledones*, sub-class *Calyciflorœ*. They are herbs or shrubs. The order comprises nearly 300 genera and upwards of 1,500 species, the greater number being confined to the northern parts of Europe, Asia, and America. Their properties are extremely variable. Some are edible; others are aromatic and carminative, and in some cases stimulant and tonic, from the presence of a volatile oil; others contain a narcotico-acrid juice, which renders them more or less poisonous; while others again are antispasmodic and stimulant, from the presence of a fœtid gum-resin. The carrot and parsnip, parsley, celery, and fennel belong to this order; so also do the poisonous hemlock, cowbane, and fools'-parsley. The caraway, coriander, and anise, well known for their aromatic fruits (commonly called seeds), are umbelliferous plants.

UMBER, *umb'-r.*—A wading bird of the Heron family. The Tufted umber (*Scopus umbretta*), a native of Africa, is 20 inches long, the colour of uniform umber brown, and a long bill. The male has a crest of loose feathers, about 4 inches long.

UMBILICAL CORD, *um-bil'-i-kal.*—The navel string, the bond of communication between the fœtus in the womb and the mother.

Umbilical Hernia.—The protrusion of intestine at the navel.

UMBRELLA, *um-brel'-la.*—A genus of gasteropod molluscs, so called from the resemblance of their flattened shell to an umbrella. *U. umbellata*, the Chinese umbrella shell, is a native of the Indian Ocean.

UMBRELLA BIRD.—The popular name of a bird, native of South America, now generally classed among the *Ampelidæ*, or Chatterers, subfamily *Gymnodesimæ*, or fruit birds. The *C. ornatus* is about as large as a crow, glossy black, with violet blue and metallic reflections. The head of the male is surmounted by a large crest of feathers, the lower half a stiff white shaft, and terminating in a tuft of black hair-like feathers spreading in all directions, but principally forward. It is 5 inches in length, and nearly of the same width. A cylindrical fleshy process, about as thick as a goose quill, and $1\frac{1}{2}$ inches long, grows from the skin of the neck, and from it extends a tuft of feathers, several inches long, and bordered with metallic blue. The bird is found in the islands of the South American rivers. From its loud and deep notes it is named by the natives the piper-bird.

UNGUICULATA AND UNGULATA, *un-gu-ik'-u-la-ta, un-gu-la'-ta.*—Terms originally applied by the naturalist Ray to mammals, according as they possessed claws or hoofs. More recent naturalists have modified this system, and Cuvier restricts the unguiculates to the monkeys and carnivora, and the ungulates to the omnivora, ruminants, and pachyderms. Huxley separates the ungulates with the perissodactyls, or odd-bred, and artiodactyls, or even-toed; the former including the rhinoceros, tapir, and horse, the latter the omnivorous pig, the hippopotamus, and the ruminating animals.

UNIVALVES, *u'-ne-valves.*—Shells consisting of a single piece.

UPAS, *yu'-pas.*—The poison-tree of Java (*Antiaris toxicaria*), concerning which so many fabulous stories are related. The milky juice is extremely poisonous, but there is no foundation for the belief that the tree poisons the air. The active principle contained in the juice has been named *antiarin*. The tree belongs to the *Artocarpeæ*, or bread-fruit family. It is a handsome tree, reaching 100 feet or more in height. The juice of the tree is collected by the natives for the purpose of poisoning arrows and other weapons. The inner bark affords a fibre which is spun into cloth and worn by the poorer classes as a substitute for linen; but if it get wet, an intolerable itching is produced.

URANIUM, *yu-rai'-ne-um.*—A metal somewhat sparingly distributed over the surface of the earth in the mineral pitchblende, which consists of the black oxide mixed with silica and oxide of iron; uran-mica, or chalcolite, which is a double phosphate of copper and uranium; and uranite, in which lime takes the place of copper. Uranium was discovered by Klaproth, and the metal was first isolated by Peligot, the substance originally supposed to be the metal having been proved by him to be the protoxide. The metal is obtained by several processes, the most simple being by heating the protochloride with potassium. Uranium thus obtained is of a white colour, to a certain extent malleable; it is not oxidized by water at ordinary temperature, but if heated in the air, it burns brilliantly like magnesium. Sulphuric and hydrochloric acids dissolve it, with the evolution of hydrogen. It forms three oxides.

URANUS, *yu-rai'-nus.*—The name of the remotest known planet, except Neptune, belonging to our system. It was originally denominated the *Georgium Sidus*, and then *Herschel*, from the name of its discoverer. The motion of Uranus is direct, or from west to east, during the greater part of the year. It is stationary for some time before opposition, and for some time after, and the motion is retrograde, attaining its minimum value on the day of opposition. The time of a synodic revolution of the planet, or the time which elapses between two consecutive conjunctions, is 369 days. The mean distance from the sun of Uranus is 19·18239, that of the earth being considered as unity. The diameter of the planet is about 35,000 miles, or nearly four and a half times that of the earth, and its bulk about eighty times that of the earth. Uranus presents the appearance of a small, round, and uniformly illuminated disc, without rings, belts, or discernible spots. From analogy, we infer that it revolves about its axis, but of this there is no direct proof. It has eight satellites. Uranus was discovered by Sir William Herschel at Bath, on the 13th of March, 1781. It had been previously observed by other astronomers, but, owing to the inferiority of their telescopes, they never suspected it to be a planet.

UREA, *yu-re'-a.*—One of the few organic bases of animal origin. It forms an essential constituent of the urine of all animals, and is most abundant in that of the mammalia, particularly so in the case of the carnivora. It is the principal outlet of nitrogen from the system after the materials which compose the animal tissues have experienced oxidation under the influence of inspired air. A person in good health secretes about an ounce of urea daily. Urea does not appear to be formed in the kidneys, those organs appearing to act more as filters in separating it from the mass of blood in which it is formed before it reaches them. Urea may be formed artificially in several ways, and was one of the first organic products made from inorganic materials. Cyanate of ammonia is metameric with urea, and is converted into it by evaporating at a gentle heat. It is also formed by the action of oxidizing agents in uric acid, and by a number of other processes. Urea constitutes about one and a half per cent. of the urine of a healthy person, or about one-third of its solid constituents.

UREDO, *yu-re'-do* (Lat., *urere*, to burn).—A genus of Fungi, the species of which produce the diseases of corn and other cultivated plants, called blights, rusts, &c.

URETHRA. (*See* BLADDER.)

URIC ACID, *yu'-rik.*—This very important excrementitious product occurs in small quantities in human urine, to the extent of rather less than one per cent. of the solid matter contained in it. It is met with in much greater abundance in the excrement of birds and reptiles, that of the boa consisting almost entirely of urate of ammonia. Guano also contains large quantities of it, and has been most extensively employed as its source in the now almost extinct manufacture of murexid dyes. When excess of uric acid is secreted in the system, it deposits hard crystalline grains in the bladder, which, if retained, gradually form concretionary calculi, and growing into the disease known as gravel or stone. In gouty patients, uric acid accumulates round the joints, forming white friable concretions, known improperly as chalk-stones. Pure uric acid is a white crystalline powder, requiring 10,000 parts of water for solution to which it imparts a very feeble acid reaction. It is insoluble in alcohol and ether, but dissolves in concentrated sulphuric acid, which deposits it in a hydrated condition on dilution. The urates of the alkalies are much more soluble than the acid itself. Uric acid is dibasic, giving rise to acid and neutral salts. By being submitted to heat, uric acid breaks up into a number of compounds; but the remarkable number of definite and crystallizable substances which it gives rise to when treated with various oxidating agents present the highest physiological interest, inasmuch as the great changes which occur in the animal economy under the influence of vitality are always accompanied by oxidation.

URINE, *yu'-rin* (Lat., *urina*).—A highly complex fluid, secreted from the blood by the kidneys. In a healthy person, when recently voided, it is a clear limpid fluid, of a pale yellow or amber colour, with a peculiar, faint aromatic odour, which becomes pungent and ammonical when decomposition takes place. Often, however, as it cools, it becomes opaque and turbid, from the deposition of part of its constituents previously held in solution; and this may be consistent with health. Healthy urine may, however, be nearly colourless, or of a brownish or deep-orange tint, and may present every shade of colour between these extremes. The quantity secreted in twenty-four hours depends upon the amount of fluid drunk, and the quantity secreted by the skin; but generally it is about from thirty to forty fluid ounces. Medical men distinguish three kinds of urine—(1) *urina sanguinis*, or that which is secreted from the blood at times when neither food nor drink has been recently taken, as in the morning before breakfast; (2) *urina potûs*, or that which has been secreted after any considerable quantity of fluid has been taken into the body; and (3) *urina cibi*, or that secreted during the period immediately succeeding a meal of solid food. The last of these contains a larger quantity of solid matter than either of the former, both of which are largely diluted with water. The first, or morning urine, is the best for analysis: it is from it that we are best enabled to learn the state of the kidneys, and the system in general.

URSA MAJOR, *ur'-sa mai'-jor* (Lat.).—The Great Bear, one of the most remarkable of the northern constellations, situated near the pole. It contains the stars which form "the Dipper," or "Charles's Wain."

URSA MINOR, *mi'-nor* (Lat.).—The Lesser or Little Bear, the constellation nearest the north pole. It was called by the Greeks Cynosura, or the Dog's tail, and may be easily distinguished by seven stars in the same form, but in a contrary position to those in Ursa Major. The star at the extremity of the tail is the North Star, marking the position of the North Pole.

URSON, *ur'-son*.—An American quadruped (*Erythion dorsatum*), having some resmblance to the porcupine, and commonly known as the Canadian porcupine. It is about the size of a small hare. The quills are worked up into ornamental articles by the Indians.

URTICA, *ur'-te-ka* (Lat.).—The Nettle, the typical genus of the natural order *Urticaceæ*. The species are well known from their stinging hairs. Some yield useful fibres; thus Caloee hemp, or Rhea fibre, is obtained from two Asiatic species.

URTICACEÆ, *ur-te-kai'-se-e*.—The Nettle family, a natural order of *Dicotyledones*, sub-class *Monochlamydeæ*. Herbs or trees with a watery juice. There are 23 genera and 300 species distributed over the globe.

URUS. (*See* AUROCH.)

UTRICULARIA, *yu-trik-yu-lair'-e-a* (Lat., *utriculus*, a little bladder).—The bladderwort, a genus of aquatic marsh plants. (*See* BLADDERWORT.)

UVULA, *yu'-vu-la* (Lat., *uva*, a grape).—In Anatomy, is a small fleshy protuberance which hangs at the middle of the posterior margin of the soft palate. In the case of sore throat, it frequently becomes enlarged and inflamed, and is to be treated by the application of stimulants and astringents in gargles. When other means fail it may be amputated, an operation neither painful nor dangerous.

V.

VACCINIACEÆ, *vak-sin-e-ai'-se-e*.—The Cranberry family, a natural order of *Dicotyledones*, sub-class *Corolliflorœ*. Shrubs or small trees remarkable for their astringent leaves and bark, and for their edible sub-acid fruits. There are about 200 species, chiefly natives of the temperate regions of the globe; they are comprised in thirteen genera. (*See* VACCINIUM.)

VACCINIUM, *vak-sin'-e-um*.—The typical genus *Vacciniaceæ*. The fruits of several species are edible; thus *V. Myrtillus* yields the bilberry or blackberry; *V. uliginosum*, the bog or black whortleberry; and *V. Vitis-idæa*, the red whortleberry or cowberry. The bog whortleberry is said to be narcotic, and to be employed for making beer "heady."

VACUUM, *vak'-yu-um* (Lat.).—In Physical Science, a space devoid of all matter. The ancients distinguished a *vacuum concervatum* and a *vacuum interspersum* or *disseminatum*. By the former they understood a place destitute of matter; by the latter, the space supposed to be naturally in the interstices between different bodies.

VALERIANACEÆ, *va-le-re-an-ai'-se-e* (from Valerius, the first who described it).—The Valerian family, a natural order of *Dicotyledones*, sub-class *Corolliflorœ*. Herbs with opposite exstipulate leaves and cymose flowers. They are chiefly remarkable for the presence of a strong-scented volatile oil, which renders them medicinally active as stimulants, antispasmodics, and tonics. Some are highly esteemed in the East as perfumes, but they are not generally considered agreeable by Europeans. The root of *V. officinalis*, a plant common in ditches and damp places throughout Europe, is the officinal valerian of the British pharmacopœias. It is much employed as a nervous excitant and antispasmodic. The roots of other species have similar properties, and are used in different parts of the world. The species *V. olitoria* is occasionally used as a salad plant, both on the continent and in Britain. The young leaves are alone eaten. In France they are known by the name of *mâche*, and in England by that of Lamb's lettuce.

VALLEY. (*See* GEOLOGY and PHYSICAL GEOGRAPHY.)

VALLISNERIA, *val'-is-ne-re-a*.—A genus of indigenous aquatic plants, belonging to a small family, the *Hydrocharidaceæ*, water or marshy plants. *V. spiralis* is found in the fresh water of both hemispheres, especially in warm climates. The stem, or rootstalk, lies in the mud. The tape-like leaves are sometimes two feet in length. They are dark green and totally submerged. There is another species, exclusively Australian.

VAMPIRE. (*See* BAT.)

VANADIUM, *van-ai'-de-um*.—A rare metal found in certain Swedish and English iron-ores, in bauxite, in many clays, and in the form of vanadrate of lead. It is a white metal, forming a blue solution with nitric acid, but not dissolving readily either in sulphuric or hydrochloric acids.

VANDA, *van'-da.*—A genus of plants of the natural order *Orchideæ*, natives of India. One very beautiful species, *V. cærulea*, with blue flowers, is highly prized by cultivators in this country.

VANILLA, *va-nil'-la* (Spanish, diminutive of *vaina*, a sheath).—A genus of the natural order *Orchidaceæ*. The species are remarkable for their fragrant odoriferous fruit, which constitutes the vanilla, or vanile, so much used for flavouring chocolate and in perfumery. On the continent, vanilla is occasionally employed as a medicinal agent in hysteria, &c. The fruits of *V. planifolia* and *V. aromatica* are the most **fragrant.**

VAPOUR, *vai'-por.*—An invisible elastic fluid, rendered aeriform by heat, and capable of being condensed or brought back to the liquid or solid state by cold. Vapourization is the conversion of the particles of liquids, and, in some instances, of solids, into a gaseous condition. When the action takes place from the surface, it is called evaporation; when from the interior of the mass, ebullition. (*See* BOILING POINTS.)

VARANIDÆ, *va-ran'-i-de.*—A species of Saurian reptiles found in Eastern countries, some aquatic, and some inhabiting dry and sandy places. Some specimens are of great size.

VARICOSE VEINS, *var'-i-kose.*—Veins swollen in certain parts of their course, generally the veins of the lower extremities, the rectum and the spermatic veins. The condition arises from debility, some diseases of the liver, heart, or lungs, or high living; and in some cases it is hereditary. Ulcers are sometimes formed; and the vein is liable to burst, in which case not a moment should be lost in obtaining surgical assistance. A horizontal position should be assumed, and the leg elevated.

VATERIA, *va-te'-re-a.*—A genus of the natural order *Dipteraceæ*. The most interesting species is *V. indica*, the source of the oleo-resinous substance known in India as piny resin or piny dammar, and used as a varnish and for making candles.

VEGETABLE ALKALOIDS. (*See* ALKALOIDS, VEGETABLE.)

VEGETABLE IVORY. (*See* PHYTELEPHAS.)

VEGETABLE KINGDOM, *vej'-e-ta-bl* (Fr., from Lat., *vigeo*, I grow).—The term commonly applied to one of the three primary divisions of nature. It includes all those organized beings which are called plants. (*See* ANIMAL KINGDOM AND BOTANY.)

VEGETABLE MARROW. (*See* CUCURBITA.)

VEGETABLE WAX. (*See* WAX.)

VEINS, *vains* (Fr., *veine*; Lat., *vena*, a vein).—Those organs of circulation by which the blood is taken up from the arteries and conveyed to the heart. (*See* CIRCULATION OF THE BLOOD.)

In Mineralogy.—Deposits of metals found in mines, the general formation being in nearly regular lines.

VENOM, *ven'-om.*—A poisonous secretion produced in some animals. The characteristics of venom, as distinguished from poisons in general, are, that it is of organic origin, produced in "poison" glands, and that it is introduced into the tissues by means of special organs, stings, or fangs.

VENTILATION. (*See* WARMING and VENTILATION.)

VENUS, *ve'-nus.*—The name of the planet which is nearest to the earth, and, with the exception of Mercury, nearest to the sun, the mean distance being 66,134,000 miles. Venus, like Mercury, from the orbit being entirely within that of the earth, is never more than a certain angular distance from the sun; her greatest angular distance or elongation being from 45° to 47° 12'. The real diameter is about 7,510 miles, and the volume is ·855 that of the earth. The density exceeds that of the earth in the proportion of 103 to 100. This planet revolves on its axis in about 23h. 21m. 7s. Its light and heat are to that of the earth as 1,911 to 1,000. The velocity with which it moves in its orbit is about 80,000 miles an hour. The period of rotation constitutes the day, 23 hours, 21 minutes, 22 seconds. It exhibits phases like the moon, and its variations in brightness in different parts of its orbit are very remarkable. The transits of Venus are of very rare occurrence, taking place at the very unequal but regularly-recurring intervals of 8, 122, 8, 105, 8, 122, &c., years in succession, and always in June or December. As astronomical phenomena, they are extremely important, since they afford the best and most exact means we possess of ascertaining the sun's distance, or its parallax. The name of the planet is suggested by its great brilliancy.

VENUS'S FLOWER BASKET.—A popular name for a beautiful silicious sponge (*Euplectella speciosa*), found among the Philippine Islands. It is of the shape of a cornucopia, from 6 to 15 inches high and about an inch in diameter at the base, widening towards the top. It is made up of silicious fibres, running from base to top, surrounded by smaller ones, forming open meshes resembling a basket, or delicate lace-like fabric.

VENUS'S FLY TRAP. (*See* DIONÆA.)

VENUS'S GIRDLE.—A jelly-fish (*Cestus Veneris*) of the *Medusæ* order. It forms a ribbon-shaped body 4 or 5 feet long. It is common in the Mediterranean, especially near Naples, appearing at night like a band of phosphorescent flame.

VERATRUM, *ve-rai'-trum.*—A genus of the natural order *Melanthaceæ*. *V. album* is the white hellebore. (*See* HELLEBORE.)

VERBASCUM, *ver-bas'-kum.*—A genus of the natural order *Scrophulariaceæ*. *V. Thapsus* is commonly called the Great mullein; its leaves have emollient, demulcent, and slightly narcotic properties.

VERBENACEÆ, *ver-ben-ai'-se-e.*—The Vervain family, a natural order of *Dicotyledones*, sub-class *Corolliflora*. They are herbs, shrubs, or trees. The plants of this order are found both in temperate and tropical regions. There are 45 genera and 663 species. Some are valuable timber trees. The fleshy fruits of some species are edible. The leaves of two or three are used as substitutes for China tea. Many are cultivated in our gardens for the beauty of their flowers and for their fragrance; as the different species and varieties of *Verbena*; the *Aloysia*, or *Lippia citriodora*; the sweet verbena, or lemon-plant, &c.

VERMIFUGE, *ver'-me-fuje* (Lat., *vermis*, a worm; *fugo*, I drive away).—A medicine made use of to expel intestinal worms, an anthelmintic.

VERTEBRÆ. (*See* SPINE.)

VERTIGO, *ver'-te-go* (Lat., from *vertere*, to turn).—A symptom of cerebral disturbance, in which objects appear to turn round. It may arise from too much or too little blood sent to the brain; from poisons in the circulation, as in alcoholic and other intoxicants; and from lesions of the sensorial centres, or the nerves therewith connected. It is commonly a symptom of congestion of the brain, and not unfrequently indicates an approaching attack of apoplexy, epilepsy, or paralysis.

VERVAIN. (*See* VERBENACEÆ.)

VESPIDÆ, *ves'-pi-de.*—The scientific term applied to the wasp family of insects. (*See* WASP and HORNET.)

VETCH.—The name of plants, known also as Tares, of the genus *Vicia*, belonging to the *Leguminosæ*, and closely related to the pea and lentil. *V. Sativa* is extensively cultivated as fodder for cattle and affords a very nutritious food, and the seeds are much liked by poultry and pigeons.

VETERINARY SCIENCE, *vet'-e-re-na-re* (Lat., *veterinarius*, pertaining to domestic animals).—The arts of medicine and surgery, as applied to horses, cattle, dogs, and other domestic animals. The Veterinary College was established at Camden Town, London, in 1791.

VETIVER, *vet'-i-ver* (East Indian, *vitivagr*).—A name given to several grasses of the genus *Andropogon*, which possess marked aromatic properties. The oil of lemon grass, so much used in modern perfumery, is from *A. schœnachus*, and the roots of an Indian species *A. muricatus*, is the vetiver of French perfumers. The odour is limited to the root of the plant, which in India are used to preserve stuffs and clothing from insects, and are interwoven into screens of lattice-work which are placed in windows, and when wetted give to the air which passes through them an agreeable odour.

VIBURNUM, *vi-bur'-num.*—A genus of the natural order *Caprifoliaceæ*. The species *V. Tinus* and *V. Opulus* are much cultivated in shrubberies, the former being known as the laurustinus, and the latter as the guelder rose. *V. Lantana*, the mealy guelder rose or wayfaring tree, has a very acrid thinner bark, which is sometimes employed as a vesicant. The leaves of *V. casinoides*, mixed with those of *Prinos glaber*, are employed in North America as a substitute for tea, under the name of Appalachian tea.

VICTORIA, *vik-to'-re-a.*—A genus of the natural order *Nymphæaceæ*. *V. regia* is a native of equatorial America, and has been introduced into this country. The flowers when fully expanded are more than a foot in diameter, and the leaves, which are curiously turned up at their edges, vary from four to eight feet in diameter. The plant is commonly known in this country as the Victoria water-lily, and in South America as the water-maize, from its edible seeds, which are commonly roasted with maize or Indian corn.

VILLARSIA, *vil-lar'-se-a.*—A genus of plants of the natural order *Gentianaceæ*, widely diffused, and either aquatic or marsh plants. The flowers are yellow.

VINE. (*See* VITIS.)

VINEGAR-PLANT. (*See* PENICILLIUM.)

VIOLA, *vi-o'-la.*—The Violet, a genus of the natural order *Violaceæ*. The species *V. odorata* is the March or sweet violet, the flowers of which have always been highly esteemed for their fragrance. An infusion of the syrup is a useful chemical test, as the violet or purplish colour is changed red by acids, and green by alkalies. *V. canina* is the dog-violet, and *V. tricolor*, the pretty little plant from which all our cultivated varieties of pansy or heart's-ease have been derived.

VIOLET. (*See* VIOLA.)

VIPER, *vi'-per* (Lat., *vivipara*, bringing forth young alive).—The type of the *Viperidæ*, a family of poisonous reptiles belonging to the order *Ophidia*, or snakes. The *Viperidæ* consist of two sub-families: namely, the *Crotalidæ*, or rattlesnakes, which will be found treated of in their proper place; and, secondly, the true vipers of the Old World, which differ from the former by their not having pits in the sides of the face. The common viper known in Europe (*Vipera Berus*) is found in all countries from the north of Russia and Sweden down to the shores of the Mediterranean Sea. It is the only venomous reptile found in Great Britain. It is met with generally in stony places, heaths, and other dry districts. Its length rarely exceeds two feet, although some specimens have been found of three feet; and it can be easily distinguished from the common snake, for which it is often mistaken, by its broad head of triangular shape, and short tail. Its colour is generally yellowish-brown, or olive-tinted, and marked with a double row of black spots; the sides are somewhat paler in the hue of their ground-colour, but possess the same markings as the back. The tongue is very long in comparison with the size of the body, and is protractile and forked at the extremity. Vipers are viviparous, bringing forth young instead of eggs; and their general food consists of young birds, field-mice, worms, insects, shrews, and such-like small animals. Although the poison of the viper is less virulent in its nature than is the case with similar reptiles found in warm countries, yet it is often attended with the most alarming effects, ending sometimes even in death. Another species, called the horned viper (*Cerastes Hasselquistii*), is found along the valley of the Nile and the warmer parts of Northern Africa; it is, in fact, the viper which is seen usually depicted on Egyptian obelisks and monuments. The short-tailed viper, or puff-adder, of the Cape of Good Hope (*Vipera inflata*), is another variety, and is the most deadly of the snakes of South Africa. The death-adder of Australia (*Acanthophis antarctica*) is the most dangerous and fatal of smaller reptiles. Persons are asserted to have died of a bite from the death-adder in less than a quarter of an hour afterwards, so sudden have been the effects of the poison. In appearance and general characteristics, this variety is nearest to the typical species.

VIRGINIA CREEPER, *vir-jin'-i-a.* — A woody climbing vine of the grape family, a native of North America, but naturalized in this country. In autumn, the colour of the leaves changes to scarlet or purple. It forms a separate genus, *Ampelopsis*. A Japanese species, *A. tricaspidata*, has smaller leaves, which also change colour in the autumn.

VIRUS. (*See* VENOM.)

VISCUM, *vis'-kum.* (*See* MISTLETOE.)

VISION. (*See* EYE and LIGHT.)

VITACEÆ, *vi-tai'-se-e.*—The vine family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*. There are probably 8 genera, including some 260 species, which are exclusively natives of warm and tropical regions. (*See* VITIS.)

VITEX, *vi'-tex.*—A genus of the natural order *Verberaceæ*, either trees or shrubs. *V. Agnus castus*, the Chaste tree, grows in the countries bordering on the Mediterranean, and takes its singular name from the practice of Greek matrons who strew their couches with its leaves at certain seasons, they being supposed to have the power to banish impure thoughts. It has been stated that a syrup made from the leaves is used in convents for a similar purpose. In the Levant, the seeds are used as an external remedy for the colic.

VITIS, *vi-tis.*—The Vine, a genus of the natural order *Vitaceæ*. *V. vinifera*, the plant commonly known as the grape vine, is supposed to be a native of the shores of the Caspian, but is now completely naturalized in the south of Europe, and cultivated in almost every region of the globe where the temperature does not rise too high or fall too low. The varieties which have been developed by cultivation are very numerous, more than 300 being distinguished. The fruits, under the name of grapes, are too well known to need description. They have been in use for the making of wine for at least 4,000 years. Dried grapes are generally called raisins. The leaf of the vine is astringent, and has been used in diarrhœa. *V. vulpina* and *V. Labrusca*, natives of North America, yield inferior fruits, which are known as fox-grapes.

VITUS, ST., DANCE. (*See* CHOREA.)

VIVIANIACEÆ, *viv-e-an-e-ai'-se-e.* — In Botany, a small natural order of *Dicotyledones*, sub-class *Thalamifloræ*. The species are herbs or undershrubs, inhabiting Chili and South Brazil.

VIVERRIDÆ, *vi-ver'-ri-de.*—A family of *Carnivora*, including the civet and other animals, secreting fluid of an offensive odour.

VOCHYSIACEÆ, *vok-e-se-ai'-se-e.* — The *Vochysia* family, a natural order of *Dicotyledones*, sub-class *Calycifloræ*, consisting of trees and shrubs. They are all natives of equinoctial America.

VOICE, AND SPEECH, *voise* (Lat., *vox*). —In most air-breathing vertebrate animals, there are certain provisions made for the production of sound in some part of the respiratory apparatus. In many animals, the sound thus produced admits of being variously modified and altered—to the greatest extent in man, so as to constitute speech. Voice and speech, however, are different things, and depend upon different parts of the human organism—the former being produced in the larynx, the latter chiefly by the tongue and mouth. The sound of the human voice is produced by the inferior laryngeal ligaments or vocal cords, which are thrown into vibrations by currents of expired air impelled over their edges. They contain a large quantity of elastic tissue, which enables them to vibrate like tense membranes, and are likewise so attached to the cartilaginous parts of the larynx that they can be made tense either by the depression of the thyroid cartilage towards the cricoid by means of the cricothyroid muscles, or by the retraction of the arytenoid cartilages, which are moved backwards by the posterior crico-arytenoid muscles, at the same time that they are approximated by the posterior arytenoid. (*See* LARYNX.) For the deepest notes, the vocal cords are much relaxed by the approximation of the thyroid to the arytenoid cartilages; for the middle notes of the natural voice, the cords are neither relaxed nor stretched, but in a medium state; while the higher notes are produced by the lateral compression of the cords, and narrowing the space between them by means of the thryo-arytenoid muscles, and also by increasing the force of the current of air. Voice is of three kinds:—(1) Monotonous, in which the notes have nearly all the same pitch, as in ordinary speaking; (2) discordant, or the successive transition from high to low notes, and *vice versâ*; and (3) musical, in which each sound has a determinate number of vibrations, and accords with others, as in singing. The first of these constitutes the speech voice, the last the song voice.

VOLCANOES, *vol-kai'-noze* (Ital., from Vulcan, the god of fire). (*See* PHYSICAL GEOGRAPHY.)

VOLE.—A genus (*Arvicola*) of rodent quadrupeds, generally considered as a sub-family of *Muridæ*. The field-mouse, water-rat, and lemming belong to this group.

VOLLEY, *vol'-le.*—The simultaneous discharge of a number of rifles or other small arms. *Salvo* is the term applied to a similar discharge from cannon.

VOLTAIC ELECTRICITY. (*See* ELECTRICITY, VOLTAIC.)

VOLUME, ATOMIC. (*See* ATOMIC VOLUME.)

VOLUMETRIC ANALYSIS, *vol-u-me'-trik.*—By volumetric analysis is understood the method of determining the amount of any substance known to be contained in a certain quantity of liquid, by observing the number of measures of test liquid capable of producing a certain effect. The test liquid, of course, contains a known quantity of the test to be used.

VOLVULUS, *vol'-vu-lus* (Lat., *volvere*, to twist).—A surgical term signifying a twisting of the intestines producing obstruction. The result is generally fatal.

VOMITING, *vom'-it-ing.*—The act of ejecting the contents of the stomach, due in a great part to the contraction of the abdominal muscles, the diaphragm remaining fixed, affording a firm surface against which the stomach is pressed. It is a common symptom of many diseases of the stomach and intestines, and arises from sympathy in affections of other organs. The movement of a ship, especially when the sea is in any degree rough, generally produces vomiting in persons unaccustomed to the sea. Females are subject to sickness of this kind in the early period of pregnancy. Ordinarily, vomiting acts as its own remedy, the expulsion of the irritating contents of the stomach being sufficient to relieve the system from any further disturbance.

VORTEX, *vor'-tex* (Lat., a whirlpool).—A circular eddy, observable in fluids, the cause of which has been the source of much perplexity to mathematicians.

VORTICELLIDÆ, *vor-ti-sel'-li-de.*—A family of *Infusoria*, minute and bell-shaped, each placed at the top of a long flexible stalk, the other end of which is generally attached to the stem or leaf of an aquatic plant. The Stentors, or Trumpet Animalcules, belong to this family.

VULTURE, *vul'-tsher* (Lat., *vultur*).—The type of the *Vulturidæ*, a family of rapacious birds belonging to the order *Accipitres* and subfamily *Diurni*. The characteristics of the family are as follows:—Bill rather elongated, occasionally slender, but generally strong, and always straight in its basal portion, but rather suddenly hooked at the tip; the eyes placed on the sides of the head, but not, as in the *Falconidæ*, shaded by the bony ridge of the beak; wings long and pointed; tarsi short, stout, and curved, with reticulated scales; and the toes of moderate size—the hinder one short and rather elevated, and all armed with strong blunt claws. The habits of the vulture tribe differ from those of the eagle in this respect, that the eagle, unless violently pressed by hunger, will not stoop to carrion, loving to kill and catch for itself; whilst the vulture is indiscriminately voracious, though not so frequently attacking living animals, as its wants can readily be supplied by the putrid bodies of those that are dead. It appears to delight in loathsomeness, and is sometimes found uprooting new graves in order to satisfy its longing appetite with their contents. The vultures are the scavengers of hot climates, and as such are often venerated and treated with respect rather than abhorred and despised. The species of the vulture is not very numerous, and their distribution seems to be wisely regulated according to their usefulness. They are sparingly scattered over Europe, are more numerous in Egypt, and abound in tropical America, on an increasing scale, in proportion to their sphere of action. There are two principal groups or families—the *Vulturidæ*, or true vultures, which are characterized by their possession of strong bills, and their nostrils being placed perpendicularly; and the *Sarcoramphinæ*, or condors, characterized by their having slender, lengthened bills, and longitudinal exposed nostrils. (*See* CONDOR.) Of the European species, the Griffin vulture (*Vultur Gyps fulvus*) may be taken as the type. This bird is found inhabiting the provinces of Silesia, Dalmatia, Spain, the Tyrol, the Alps, the Pyrenees, Turkey, the Grecian Archipelago, and also the north of Africa and Persia. It is about four feet in length. Its head and neck are thickly covered with white down, except at the crop, where the skin is naked and tinged with blue. Round the lower part of the neck there is a sort of ruff, made of pure white slender feathers, and the rest of the plumage is generally a grayish or yellowish-brown, with the exception of the feathers of the inside of the upper parts of the legs, which are, like the ruff, pure white. It always builds its nest upon the highest and most inaccessible rocks, or upon the tops of lofty trees in mountainous regions. The Sociable vulture (*Otogyps auricularis*) is one of the largest species, measuring sometimes ten feet in the extent of its wings. This variety is a native of South Africa, and is appropriately named from the fact of the species always congregating in large numbers together, when not even in pursuit of prey.

W.

WADERS, OR WADING-BIRDS. (*See* GRALLÆ.)

WAGTAIL, *wag'-tail.*—A genus (*Motacilla*) of birds, natives of the temperate regions of the Old World, with long slender bills, pointed wings, and long narrow tails, which are incessantly wagged up and down. They run with great swiftness, live on insects and small seeds, and are generally met with in moist places. A common British species, the Pied wagtail (*M. Yarrellii*), is about 8 inches long, including the tail, and is black, varied with white on the upper parts and white below. There are also White, Gray, and Yellow wagtails.

WALLABA TREE, *wol'-la-be.*—A South American tree (*Eperva foliata*), of the natural order *Leguminosæ*. The wood is of a deep red colour, in some cases having whitish streaks, hard, heavy and very durable.

WALLFLOWER.—The popular name (from its growing when wild in rocky places and on old walls) of a perennial cruciferous plant, *Cheiranthus Cheiri*. It is a native of Southern Europe, and was introduced into England about 300 years since, and was generally known as the gilliflower. Cultivation has produced many varieties. The flowers vary in colour from yellow to crimson, and some are beautifully variegated. The flowers emit a most agreeable odour, especially at evening. The choicer kinds are propagated by cutting.

WALNUT, *wal'-nut.*—The common name of large nut-bearing trees of the genus *Juglans*, (which *see*). The European walnut (*J. regia*) is a native of Asia, but grows abundantly in nearly all parts of Europe. The timber is beautiful in grain and colour, and is much used for cabinet work, the fruit, when partially green and soft is used for pickling, and to make walnut ketchup. In countries where the trees abound, the nuts are pressed for their oil, used in food as a substitute for olive oil, and a second pressing, after heating the residue, is used by house painters and artists, in the manufacture of the finer kinds of printing ink, and sometimes for burning in lamps. The nuts themselves are in gre t favour as a dessert fruit. An infusion of the le ves has been found beneficial as a remedy for scrofula and other skin diseases, and a kind of liquor is made from the sap, also used for a kind of wine.

WALRUS, *wol'-rus*, (Ger., *wall*, a whale; *ross*, a horse).—A species of the *Phocidæ*, or Seals, a family of marine animals belonging to the class *Mammalia*, order *Feræ*. It is also known as the Morse, and the Sea Horse. The characteristics of the walrus are as follows:—Skull large and heavy, and the facial portion much more elongated than in the true seals; nose broad, and obtuse; teeth, six incisors in both jaws of the very young animals; but in the adults all these fall out with the exception of two, which remain in the upper jaw; the upper canines extremely long, forming a pair of pointed tusks, which pass downwards between the small canines of the lower jaw, and project a considerable distance below the chin; the molars variable in numbers, as they fall out as the age of the animal increases. The body of the animal is bulky; but in its general form, and in the position of its legs, it resembles the seals. The walrus is said sometimes to attain the length of twenty feet, and even upwards, and often weighs as many hundredweights. Its skin, it may be likewise mentioned, is covered with a thick crop of short brown hair. It is a native of the Northern Ocean and the North Pacific; and from the observations of voyagers, appears generally to feed on sea-weed. It is most abundant about the Sea of Kamschatka, and is hunted chiefly for its oil and tusks, the latter of which measure from fifteen to thirty inches in length, and weigh from five to ten pounds, and are composed of a beautiful, white, hard species of ivory. The oil is but scanty, but is far superior to that of the whale in excellence. Its flesh is coarse and unpalatable to Europeans, but is eaten by the Esquimaux, and its skin is highly serviceable in the manufacture of ropes, &c. The tusks of the walrus, it may be mentioned, are said to be principally used by him for the purpose of assisting him to climb on the ice-floats, even more so than as defensive or offensive weapons, as he is a gentle, harmless animal.

WAPITI, *wop-i-te'*.—A magnificent deer of North America, somewhat resembling the red deer of our own country, but much larger. It lives in large herds, sometimes three or four hundred strong, each of which is under the command of a leader.

WARBLER, *war'-bler*.—A common name of birds of the family *Luscinidæ* or *Sylvicolidæ*, including the wagtails, titmice, robin, nightingale, and many other well-known song-birds. There are a great number of species, North America claiming at least 40.

WART-HOG, *wawrt*.—A genus (*Phacochœrus*) of *Suidæ*, similar to the Hog, but differing chiefly in the teeth, the molars resembling in some degree those of the elephant. The name was taken from a warty protuberance on each cheek. There are several species, all natives of Africa.

WARTS (Sax., *weart*).—Hard, unsightly excrescences or tumours that form on the cuticle or outer skin, usually of the hands or some other conspicuous place. They are of slow growth, small, insensible, and generally conical in form. The best application for their removal is some caustic acid, as nitrate of silver, caustic potash, or strong acetic acid.

WASP, *wosp* (Sax., *wæsp*).—The type (*Vespa*) of the *Vespidæ*, a family of aculeated hymenopterous insects. Its chief character is taken from its wings, which are folded throughout their entire length when it is at rest, forming a pair of long narrow organs running along the back. The tongue is very long; the division between the thorax and abdomen is very deep; the colour is usually black, with yellow markings; the stings are more formidable than those of bees, and have been known to produce fatal results. The common wasp (*Vespa vulgaris*) is otherwise known by the appellation of the Social wasp, on account of its generally living in extensive communities, inhabiting a nest formed in the ground. These nests are formed of a paper-like material, prepared by the insects from vegetable substances that they find and masticate until it has acquired a pulpy consistence. Each nest is generally occupied by about a hundred females, and these are the only members of the community that survive the winter, the others dying off at the first frost. These, being previously impregnated by the males, lie in some protected spot during the duration of winter, and, as soon as the spring sets in, they set to work to build a new habitation for the hatching of their eggs. As soon as these are brought into life, the community is re-established. The larvæ are little fleshy grubs, destitute of feet, but they are supplied with lateral tubercles. These are fed daily, as before observed, by the workers with food, which is previously half-digested in their stomachs. Another English variety is the tree wasp (*Vespa britannica*), which builds its nest of a thin, paper-like substance, and suspends it from the branches of trees. (*See* HORNET.)

WATCH, DEATH. (*See* DEATH-WATCH.)

WATER, *waw'-ter* (Sax., *wæter*).—Water is presented to us in nature in three forms—solid, liquid, and gaseous. Large masses of ice exist around the poles; and water holding in solution certain mineral and gaseous matters constitutes the seas, rivers, and lakes of the temperate and torrid zones. It also exists in large quantities in the air, either dissolved in invisible vapour, or deposited in the form of clouds. In temperate and warm climates, the surface of the earth, at least, is more or less damp; while the interior of the earth itself contains numberless springs, and the minerals which exist in it contain more or less water chemically combined with them. Besides this, it is essential to all vegetables and animals in a living condition, and constitutes nearly seven-eighths of the human body. Chemically speaking, water consists of hydrogen and oxygen, united in equal equivalents by weight, of eight parts of oxygen to one of hydrogen; or by measure, one part of oxygen to two of hydrogen. The most variously contrived experiments into the composition of water always give the same result—88·889 per cent. of oxygen, and 11·111 per cent. of hydrogen. Cavendish was the first to discover its real composition. Water, as found in nature, is never pure, being always contaminated with foreign matter. Rain, which is the purest form of natural water, always contains carbonic acid and carbonate and nitrate of ammonia, and other constituents, depending on the locality in which it falls. That produced by melting fresh-water ice is free from every contamination except small traces of carbonic acid and ammonia. Pure water can only be obtained by distillation. (*See* PHYSICAL GEOGRAPHY.)

WATER-BUG.—A common name of the *Hydrocorisæ*, insects which live chiefly in water. The anterior portion of the first pair of wings is horny, and the antennæ are very small. There are two families, *Notonectidæ* and *Nepidæ*. Some of the latter are nearly three inches long, with powerful forelegs, and are popularly known as Water Scorpions.

WATER IN THE HEAD. (*See* HYDROCEPHALUS.)

WATER-CRESS. (*See* CRESS).

WATER-DROPWORT.—A genus *Œnanthe* of plants of the natural order *Umbelliferæ*. They are large perennial plants, many species of which are natives of this country. The odour is strong and disagreeable. The common and Hemlock Water-Dropworts (*Œ. fistulo* and *Œ. crocata*), common in moist situations, are narcotic acrid poisons.

WATERFALL. (*See* PHYSICAL GEOGRAPHY.)

WATER-FLEA.—A genus (*Daphnia*) of *Entomostraca*, of the order *Cladocera*. One species (*D. monoculas*) abounds in pools and ditches, swimming by taking short springs, whence its popular name. Under the microscope, it is a transparent object, showing all the interior organization.

WATER-HEN. (*See* GALLINULE.)

WATER-LILY.—A common name for the different species of aquatic plants, belonging to the natural order *Nymphæaceæ* (which *see*). Three species are known in Britain, the white water lily (*Nymphea alba*), and two kinds of yellow water lilies.

WATER-MOLE. (*See* DUCKBILL.)

WATERSHED. (*See* PHYSICAL GEOGRAPHY.)

WATERSPOUT.—At sea, during the production of a waterspout, the waters at first appear greatly disturbed, beneath a dark cloud, the waves tending rapidly towards the centre of the agitated mass. Presently a vast conical column of water rises, the whole column extending from the level of the sea to the clouds. Waterspouts appear to move with the wind. While some waterspouts are rapidly absorbed, or fall to the earth in copious showers of rain, others have been known to preserve their condition for an hour.

WATTLE-BIRD, *wot'-l*.—An Australian bird (*Anthochæra carunculata*) of the family of Honey-eaters. The name is taken from a red wattle, or hanging mass on each side of the throat. The colour is generally grayish brown on the back, each feather being striped and bordered with white, and the long wide tail is brown. It is a combative and active bird, about the size of a pigeon.

WAVE.—A term of Physical science, applied to the undulating movement of the ocean, of sound, light, and the vibrations of a stretched cord. (*See* SOUND and LIGHT.) The word is most familiar to us in relation to the movements of water. (*See* PHYSICAL GEOGRAPHY and TIDES.)

WAX PALM.—A palm (*Ceroxylon andicola*) growing on the Andes, South America, at a great elevation. It attains a height of 160 feet, and is a very handsome tree. From the leaves exude in great abundance a resinous secretion, one-third of which is a kind of white wax. (*See* WAX.) The tree is cut down to obtain it, and, on an average, about 25 lbs. of wax is yielded by a tree. The wood of this palm is hard and durable; the leaves are used for thatching, and the fibres for cordage.

WAX PLANT.—A name given to climbing greenhouse shrubs of the Milkweed family. They are natives of the East Indies. The best known species is *Haya Carnosa*, the flowers of which are generally flesh-coloured, but in some instances nearly white, and have a wax-like appearance. It is one of the few stove-plants that thrive in window culture.

WAX TREE.—A genus of plants (*Vismia*) of the natural order *Hypericaceæ*, natives of the tropical parts of America. They all yield a yellow viscid fluid, which hardens into a substance in many respects resembling wax.

WAXWING.—A genus of birds (*Bombycella*) of the family of Chatterers. There are few species, but they are very abundant in the more northern parts of Europe, Asia, and America. The name is taken from the fact that the shafts of some of the wing-feathers terminate in horny expansions resembling in appearance red sealing-wax. The only species known in Europe is the Bohemian chatterer (*B. garrula*), which migrates southward in winter, being at that season sometimes seen even in the countries bordering on the Mediterranean, but only occasionally visits this country. It is very abundant in North America, especially near the great lakes and the head-waters of the Mississippi, and is also met with in Japan. In size, it is nearly as large as the thrush; the colour is a reddish-gray, with a black patch on the throat and band on the front of the head. The tail coverts are of a brownish orange, and some of the feathers are tipped with yellow; there are two white bands on the wings; the lower parts are silvery gray, and a crest of brownish-orange feathers surmounts the head.

WAXY DEGENERATION.—In Physiology, a transformation of healthy tissue into a peculiar substance having a certain resemblance to wax. The parts most frequently affected are the spleen, liver, and kidneys.

WEALDEN FORMATION. (*See* GEOLOGY.)

WEASEL, *wee'-zel* (Sax., *wesle*).—The type of the *Muste'idæ*, a family of carnivorous animals of the order *Feræ*. They are distinguished by their long and slender bodies, by which they are enabled to worm themselves through the smallest apertures in search of their prey. They can run with considerable swiftness, notwithstanding the great length of their bodies and comparative shortness of their legs; but they more frequently take their prey by surprise, and are of a very sanguinary disposition, making dreadful havoc amongst poultry, killing scores in a night sometimes—not for the purpose of eating the flesh, but merely piercing the throats of their victims and drinking their blood. They are equal enemies to rats, mice, and other vermin, however; so that there are never any of these found in the locality where a weasel frequents. The weasel usually found in this country (*Mustela vulgaris*) measures about seven inches from the tip of the nose to the insertion of the tail, which is about two inches long. Its height is about three inches. The colour is a pale reddish brown on the back and sides, but a beautiful white beneath, and the tail is bushy. The eyes are small and black; the ears round and short; and the nose furnished with long whiskers like a cat. It moves along by unequal leaps, and is capable of springing several feet from the ground at a bound, can easily climb up a wall, and will plunge into water in pursuit of the water-rat. It is of a bold and ferocious disposition, being used to attack animals of apparently double its strength; but when taken young can be tamed. It generally sleeps during the day, and is most active at night. It can go also a long time without food, as its means of subsistence is precarious, and is known sometimes to resort to a vegetable diet when an animal one cannot be procured by it. Like other varieties of its family, as the pole-cat and ermine, it carries a fœtid odour about with it, arising from some glands secreted below the abdomen. The weasel generally inhabits the temperate parts of Europe. In some of the northern countries the fur is an article of trade, and large quantities of the skins are exported from Siberia and China.

WEAVER BIRD, *weev'-er.*—A genus of birds (*Ploceus*) of the Finch family, sub-family *Ploceinæ*. The name is taken from the method of constructing the nests, the materials of which appear to be woven together. The birds are not found in Europe or America, but in the warmer parts of Asia, Africa, and Australia. They are small birds, with strong, conical bills, and large long claws. The nests are generally suspended from the branches of trees, those which overhang water being preferred. Some of the birds, especially a species found in Madagascar, attach the nest of one year to that of the preceding, and four or five nests, one hanging to another, are seen. The Social weaving-birds of South Africa (so named from building their nests in company) construct a roof of coarse grass, to the interior of which the nests are attached.

WEEDS.—A name popularly given to plants which grow wild in cultivated grounds. They are very injurious to the regular crops, the growth of which they obstruct, besides exhausting the soil.

WEEVER, *weev'-er.*—A genus (*Trachinus*) of fishes of the family *Trachinidæ*. They remain mostly at the bottom of the sea, and often bury themselves in the sand; but can live for a considerable time out of the water. They possess the power of using one of the strong spines of their gill-covers against an assailant, and inflicting a very severe wound. It is a popular belief that the spines are coated with a poisonous exudation. Scientific naturalists, however, do not accept this as a fact. The flesh of the fish is esteemed for the table. Two species are found on the British coast—the Greater weever, or Sting-bull, nearly 12 inches long, and the Little, or Viper weever, very much smaller.

WEEVIL, *weev'-il.*—A genus of insects (*Curculio*) of the order *Coleoptera*. The species are very numerous and found in all parts of the world. They have a bad reputation as destroyers of the leaves and fruits of plants. (*See* CLOVER WEEVIL.) Many of the species are of a dull colour, others are among the most brilliant members of the family. (*See* DIAMOND BEETLE.) Weevils bore into the shoots of fruit trees and deposit their eggs in the cavity. One species is very destructive in vineyards, constructing nests by rolling up the leaf of the vine, and depositing eggs between the folds. In South America the Indians roast and eat, as a choice delicacy, the larvæ of a large species (*Calandra palmarum*) found in palm trees. The larvæ of another species (*C. sacchari*), which feeds on the sugar-cane, is also eaten in the West Indies and Guiana. A very small species (*Hylobius pales*) commits great ravages in the pine-woods of North America; and wherever the weevil is found, fruit trees, leguminous plants, and grain-crops suffer.

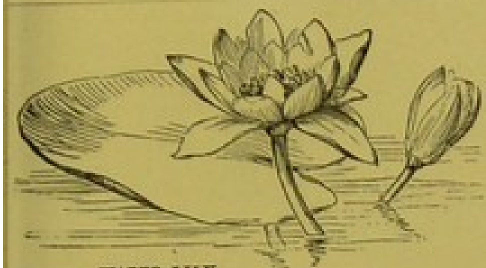
WEHR-WOLF. (*See* LYCANTHROPY.)

WELD, OR WOOLD.—A plant (*Reseda Luteola*) of the same genus with Mignonette. It is cultivated in England, France, and Belgium, on account of its yielding an important dye-stuff, which imparts a rich yellow colour to linen, woollen, and silk fabrics.

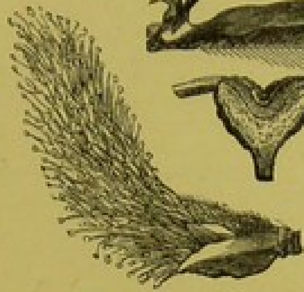
WELLINGTONIA, *wel-ling-to'-ne-a.*—The name given to a gigantic genus of trees (*W. gigantea*), of the natural order *Coniferæ*. Only one species is known, growing in a limited district of California, North America, at a height of 4,000 to 5,000 feet above the sea, on the range of the Sierra Nevada. Some of the trees are more than 320 feet in height. They were discovered in 1850, and were supposed to be the tallest trees in the world; but lately that distinction has been claimed for some gum-trees seen in Australia. Some of the Wellingtonia have been felled and found to contain about 500,000 feet of timber, sound to the centre, the age of the trees being estimated at 3,000 years. The diameter of the trunk at the base is from 25 to 30 feet.

WELWITSCHIA, *wel-vitch'-e-a.*—A remarkable plant found in some parts of the west coast of Africa, and named from the discoverer, Dr. Welwitsch. It is never above a foot in height, but the trunk is 5 or 6 feet in diameter. The seed-leaves continue to grow, and though the plant may live for more than a century, these are all the leaves it ever has. These leaves are in some cases 6 feet long and 3 feet wide, and from the upper side are produced long flowering stalks, with cones of brilliant scarlet scales, each containing a flower.

WEN, *wen* (Sax., *wenn*).—An encysted tumour, varying in size and character, and commonly situated immediately under the skin; but occurring also in some of the internal viscera. The causes of its formation are unknown, but a strongly marked tendency to such swellings exists in particular individuals, leading to the belief in constitutional causes. It is comprised in a membrane called a cyst, and its contents sometimes resemble fat or suet, at other times it contains serum or a thin fœtid brown or black fluid. Frequently the cyst, especially when small, may be punctured, and its contents pressed out; but sometimes this gives rise to very severe inflammatory action. A safer mode of treatment is to dissect them out with the knife wherever their position will admit of it, care being taken to remove the whole of the cyst; but, under any circumstances, there is always a risk attending such an operation.



WATER LILY.



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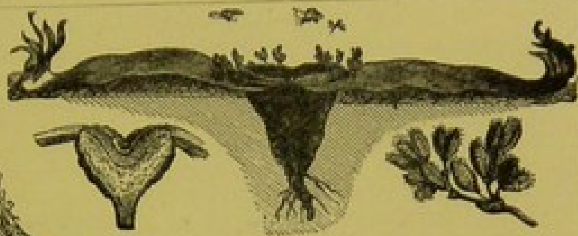


WELWITCHIA.

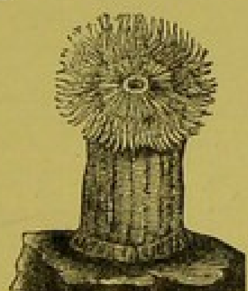
WENTLE-TRAP SHELL.

WILLOW TREE

WOMBAT.

YAM.

WOODLARK.



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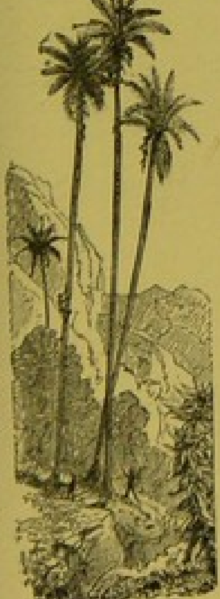

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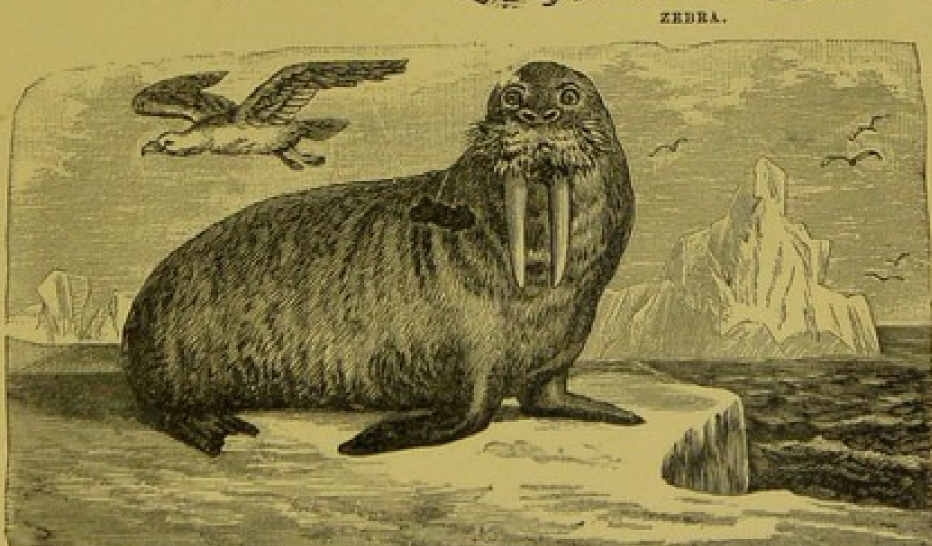

WALRUS.

WENLOCK GROUP, *wen'-lok.*—A series of rocks of the Upper Silurian age, very conspicuous in the neighbourhood of Wenlock, in Shropshire. The group is divided into Upper and Lower. The fossils in each are similar in character. (*See* GEOLOGY.)

WENTLETRAP, *wentl'-trap.*—A genus (*Scalaria*) of gasteropodous molluscs of the family *Turritellidæ.* About 100 species are known. The shell is spiral, with many whorls. The eyes of the inhabitant of the shell are placed on an external convexity; it has a proboscis, and the foot is short and oval. Wentletraps are natives of warm climates. Some of the species are very beautiful, and one species of the Precious wentletrap, found on the south-east coast of Asia, was formerly esteemed as a treasure of the highest value by collectors, enormous prices having been paid for a specimen.

WHALE, *wail.*—A genus of animals belonging to the class *Mammalia*, and order *Cetacea.* Naturalists recognize three families—*Balænidæ*, or baleen whales; *Physeteridæ*, or sperm whales; and *Delphinidæ*, or dolphins (including the porpoise, grampus, and narwhal). The whale is a marine animal, it is also viviparous, and suckles its young like other mammals. It also respires by means of lungs, and has distinctly separate blowholes. It has warm blood; and one species, the true *Balæna*, has no teeth, but instead, large plates of baleen or whalebone attached to the upper jaw. The respiratory apparatus of the whale is peculiar in the extreme: the larynx is produced into a conical form, and when the creature is breathing, projects into the cavity of the posterior nares, where it is met and embraced by the muscles of the palate, and thus a free passage is opened through the nostrils from the lungs direct to the external air, although at the same time the whole head and mouth may be under water. In order to get rid of the water which is taken into the mouth, the whale performs the act of deglutition, but at the same time closes the pharynx to prevent the passage of the water beyond the necessary point. By these means it is forced up the nasal passages, and by a sudden contraction of the muscles about these parts, is finally expelled in a jet of water, which rises to some height. The head of the whale is disproportionately large in comparison with the size of the body, generally being one-third, and often one-half, the size of the latter. The skull is generally unsymmetrical. The arrangement of the baleen or whalebone in the most of the Greenland whales (*Balæna mysticetus*) is very peculiar. A strong bony keel runs along the centre of the palate, on each side of which is a very broad depression, along which the plates of baleen are attached. These are long and flat, and are attached to the palate by their bases hanging down into the mouth. From these being placed transversely, their sides are parallel, and at a very small distance from each other, the base of each, as well as the outer edge, being composed of solid whalebone, while the inner edge terminates in a filament of fibres which fill up the whole interior of the mouth like a curtain across it. The object of this is entirely owing to the arrangement of the stomach of the whale, which is so small in comparison with his great bulk that his food consists only of the smallest of the swimming mollusca, a herring being the largest fish he can swallow. The balæna thus serves the purpose of a sort of sieve, and separates the food which the whale feeds on from the water which he cannot but take in at the same time that he seizes his prey. The Greenland whale is a native of the northern seas, abounding in Baffin's Bay. It is about 60 feet in length and 40 in circumference, and its average weight has been estimated to be about 500,000 lbs. The back and sides are covered with fat, of an exceedingly unctuous character, termed "blubber;" and so oily is this substance, that a hundred barrels of blubber will produce nearly ninety-six barrels of oil, so that the refuse and waste is but very slight. The whole body of a whale of this species, of the full size, will yield from fifty to sixty puncheons of oil, each puncheon containing seventy-four gallons; the whole value of such a fish is therefore about a thousand pounds sterling. The young ones produce about fifty barrels of oil when they are only a year old; but at that time they are particularly fat. The female produces her young alive, after a gestation of about nine or ten months. The southern whale (*Balæna Australis*) is another variety found in the southern seas, principally about Australia and New Zealand. The head of this variety is smaller in comparison than that of the Greenland whale, but its size altogether is about the same. The *Balænoptera*, or fin-backed whales, are another family, which differ from the preceding by possessing a soft dorsal fin. These are even larger than the Greenland whale, but are not so valuable, as their yield of oil is much less, and it is not by any means worth so much. The *Cachalot*, or *Sperm whale*, is described elsewhere. (*See* SPERM WHALE.)

WHALE-LOUSE.—A genus (*Cyamus*) of Crustacea. They are parasites attaching themselves to whales in such numbers, that the huge body is completely covered with them.

WHEAT, *weet*, from (Ang.-Sax., *hweete*, white).—The most valuable of all the cereal grasses, and second only to maize in productiveness, forming a genus, *Triticum.* The grass from which wheat has been developed by long cultivation is found abundantly in Central Asia, but grass of a similar character has recently been discovered in European districts bordering on the Mediterranean. Bearded wheat is that in which some of the awns, or long thin spikes of the original grass, are still to be traced. Wheat has been cultivated from the earliest ages, as are found from Biblical and other ancient mention of the grain. It is an annual plant and thrives only in temperate climates, the cultivation not extending so far north as that of barley or oats. The red varieties of wheat are more hardy than the white, but is of inferior quality; but its productiveness in some soils where the white variety does not thrive, makes its cultivation of importance. Wheat is cultivated to most advantage on clayey or rich loamy soils, and is generally sown in autumn or the beginning of winter, generally after beans, green crops, or bare fallow, in the south of England, frequently after clover. Guana, and nitrate of soda, are among the manures applied to the land. When dried, so as to be ready for stalking, the weight of grain to that of the whole plant is frequently over 40 per cent. An analysis of the grain shows us an average, out of 100 parts, water 14·83; gluten, 19·64; albumen, 0·95; starch, 45·99: gum, 1·52; sugar, 1·50 oil, 0·87; vegetable fibre, 12·34; ash, 2·36. The greater part of the husks of the grain is known, after separation, as *bran*, the more finely divided portions being known as *sharps* or *pollards*.

Wheat Fly.—The popular name of some species of dipterous insects, which frequently commit great ravages among wheat crops.

WHEAT-EAR, *weet'-ear.*—A bird (*Saxicola œnanthe*) of the genus generally known by the name of Chat. The wheat-ear in some parts of the country is known as the Fallow chat. (*See* CHAT and SYLVIADÆ.)

WHELK, *welk.*—The common whelk (*Buccinium undatum*), is a gasteropodous mollusc belonging to the family *Buccinidæ*, which contains upwards of a hundred fossil, and as many as twenty existing species. It is commonly found along the British coasts, and in the Atlantic, even as far north as Greenland. It is dredged for as an article of food, and is taken usually in deep water, being found as low as a hundred fathoms from the surface. The head of the animal is broad, with two tentacula, with the base of which the stalks, bearing the eyes, are united; there is a large proboscis, and the tongue is armed with teeth.

WHIMBREL, *wim'-brel.* — A bird (*Numenius phæopus*) having a great resemblance to the curlew, but smaller and belonging to the same genus. The length is nearly 18 inches, the plumage of a bright ash colour. It is found throughout Europe, and in Asia north of India. It is a bird of passage, and visits Britain in spring and autumn. The flesh and eggs are considered to be delicacies.

WHINCHAT, *win'-tchat.*—A bird of the class known as Chats (which *see*). The name is taken from its habit of frequenting whin, or furze.

WHIP-POOR-WILL, *wip-poor-will.* —A well-known species (*Caprimulgus vociferus*) of the Goatsucker or Night-jar, common in North America. It is about nine inches in length, and eighteen in the extent of its wings, and its plumage and characteristics strongly resemble the European Goatsucker. The name of this bird is derived from the peculiar cry which it emits, composed as it is of three distinct notes, sounding like the words *whip-poor-will*, with the emphasis laid strongly on the first and last words. The noise these birds make at night is perfectly astounding to one previously unacquainted with them; and the Indians assert that they are the spirits of departed warriors, and that their perching on any house is a token of the approaching death of one of its inhabitants. (*See* GOATSUCKER.)

WHIRLPOOL, *wirl'-pool.*—When two opposite currents of almost equal force meet, they sometimes, especially in narrow channels, turn upon a centre and assume a spiral form, giving rise to eddies or whirlpools. The most celebrated whirlpools are the Euripus, near the island of Eubœa, in the Grecian Archipelago; Charybdis, between Sicily and Italy; and the Mælstrom, off the coast of Norway.

WHIRLWIND. (*See* WIND.)

WHITE ANTS. (*See* TERMITES.)

WHITEBAIT, *wite'-bait.*—A well-known fish, *Clupea alba*, of the order *Malacopterygii*, and a member of the *Clupeidæ*, or Herring family. Formerly the whitebait was considered to be the young of the shads and sprats, but later naturalists have determined it to be of a distinct genus of its own. It is the young whitebait which are so largely taken in the Thames, and used in the whitebait dinners particular to Greenwich and Blackwall. But the larger and adult fish, which seldom exceed six inches in length, are taken in large quantities off the Kent and Essex shores during the winter. The whitebait fishery is also pursued in the Firth of Forth.

WHITEFISH. (*See* COREGONUS.)

WHITE SWELLING.—A disease of the joints, so called for being unattended by any discolouration of the skin; and it occurs most frequently in scrofulous constitutions. The knee-joint is the most subject to its attack. It is the result of chronic inflammation in the bones, cartilages, or membranes constituting the joint, and is always attended with swelling, the part being sometimes hard, at other times soft and yielding. In some cases there is little or no pain, and the motions of the joint are but little impeded; in others the skin appears of a pale shining colour, with a number of large veins running over it. At length collections of matter form round the joint, and gradually make their way outwards by various openings. The constitution is now seriously disturbed, and the health fails, till, unless speedy relief is obtained, the patient is carried off. In some cases, life is only saved by amputation.

WHITING, *wi'-ting.*—One of the smaller varieties (*Merlangus vulgaris*) of the Codfish family, of whose peculiarities it strongly partakes. It rarely reaches a pound and a half in weight, but as its flesh is very delicate, it is much esteemed as an article of food, and in consequence is in much request in the market. It abounds on all the coasts of Britain.

WHITLOW, *wit'-lo* (Sax., *hwit*, white; *low*, flame).—A very painful inflammation of one of the fingers, or sometimes, though very rarely, of the toes, and usually proceeding to suppuration. Leeches, warm fomentations, and poultices should be used in the early stages; but should this prove ineffectual, a free incision should be made down through the sheaths of the tendons, which usually affords relief, a small quantity of pus being discharged, and the disease subsiding in a few days by the use of warm fomentations and poultices.

WHORTLEBERRY, *wur'-tel-ber'-re.*—A genus (*Vaccanium*) of shrubs, of which there are many species, mostly found in northern temperate regions. The common whortleberry, known as the blaeberry in Scotland, is common in Great Britain. The berries, which have a sweet flavour, are used for making jelly. The shrub is also known as tne Hurtlebery, or Huckleberry.

WIDGEON, *wid'-jen.*—A genus (*Mareca*) of ducks, of which there are many species migratory birds. The common widgeon (*M. penelope*) is abundant in England in the winter, and at other times is met with in North and Central Asia, North America, and Japan. It is about 18 inches in length. The male bird is white on the top of the head, chestnut on the cheeks and hind part of the neck; the upper parts of the body grayish-white, with irregular black lines; the wing coverts are white, tipped with black, and the head and belly white. The female is of a reddish-brown colour, with darker speckles and shades. The cry of the bird is a shrill whistle.

WILD BOAR. (*See* HOG.)

WILD FOWL.—A name given generally to non-domesticated web-footed birds. The shooting of which affords great amusement to sportsmen.

WILLET, *wil'-let.*—A bird (*Symphemia semipalmata*) of the family *Scolopacidæ*. It is a native of North America, and generally found on the coast, in summer in the northern districts, and in winter as far south as Florida. It is about 15 inches long, of a grayish-brown colour in the upper parts, and white underneath. The flesh and eggs are considered delicacies.

WILLOW. (*See* SALIX.)

WIND, *wind.*—A sensible current of the atmosphere, and, as such, distinct from that motion of the atmosphere which is the consequence of the diurnal and annual movements of the earth, and is not perceptible. The immediate effect of the solar radiation, communicating heat to any portion of the earth's surface, is to generate an ascensional movement in the incumbent atmosphere, a bodily overflowing of its material above, and a relief of barometrical pressure below. The air of the cooler surrounding region, not being so relieved, will be driven in by the difference of atmospheric pressure so arising, and thus originate two distinct winds—an upper one setting outward from the heated region, a lower, inwards or towards it. These effects upon the earth, together with the rotary motion of the earth, are the primary causes of all the phenomena of the winds. Currents of wind thus produced may be permanent and general, extending over a large portion of the globe; periodical, as in the Indian Ocean; or variable and occasional, or, at least, uncertain, as the winds in temperate climates.

Trade Winds.—General or permanent winds blow always nearly in the same direction, and are called trade-winds; so called because they promote, more than any other circumstance, trade and navigation. These trade-winds occur in all open seas on both sides of the equator, and to the distance of 30° north and south of it. To the north of the equator they blow in the eastern parts of the ocean from the north-east, seldom from the eastward of east-north-east, or from the northward of north-north-east. In proceeding farther west, they become more easterly, and often they blow from due east, and sometimes from the south of east, but generally they are one or two points north of east. To the south of the equator, the trade-winds in the eastern part of the ocean blow from south-east, and usually between south-east and east. They do not occur in the vicinity of the continents, but are chiefly separated from them by a tract of sea, in which either periodical or variable winds prevail. The origin of them is this,—the powerful heat of the torrid zone rarefies, or makes lighter, the air of that region; the air, in consequence of this rarefaction, rises, and, to supply its place, a colder atmosphere from each of the temperate zones moves towards the equator. There are two instances of the interruption which the trade-winds experience in the neighbourhood of large masses of land. In the Indian Ocean the south-east trade-wind prevails between 28° and 10° of south latitude; but, from 10° of south latitude to the northern shores of that ocean, the uniformity of the tropical movements of the atmosphere is destroyed by the monsoons, which belong to the class of periodical winds. (*See* MONSOONS.)

WINDGALLS, *wind'-gawls.*—Swellings about the joints of horses and other animals, resulting from irritation and inflammation.

WINTERS' BARK.—A bark first introduced from the Straits of Magellan by Captain Winter in 1579. The shrub from which it is taken (*Drimys Winteri*), of the natural order *Magnoliaceæ*, is abundant in the more southern parts of South America. The bark is stimulant, aromatic, and tonic, resembling cinnamon.

WIRE WORM.—The larva of the Click Beetle, which is very destructive to the roots of crops. The largest are not more than half an inch long. Their destruction is difficult.

WISTARIA, *wis-ta'-re-a.*—A beautiful ornamental climbing plant of the natural order *Leguminosæ*, sub-order, *Papilionaceæ*. An American species, *W. frutescens*, is often 30 feet long and has very handsome and fragrant flowers of a bluish purple colour; and a Chinese species, *W. Chinensis*, runs to a length of 90 feet. In this country, the Wistaria is trained against walls.

WITCH-HAZEL.—A shrub (*Hamamelis Virginica*), a native of North America. It seldom exceeds 8 or 9 feet in height, but instances of much larger growth are known. The leaves are about 4 inches long and more than 2 inches in breadth. It bears clusters of showy yellow flowers, which appear in winter. The English name is taken from the supposed power of a parted twig as a divining rod, or supposed to indicate, by its turning, the locality of springs of water. The bark has a medicinal value.

WITHERITE, *with'-er-ite.*—A mineral from which the compound called baryta, or barytes, is obtained.

WOAD, *wode.*—A genus of plants of the natural order *Cruciferæ*. The various species, few in number, are mostly natives of the countries bordering on the Mediterranean. The plant was known in this country at a very remote period, the blue dye obtained from it having been used by the Picts and early Britons for painting their bodies. One species, Dyers' Woad, is now cultivated to a limited extent, the dye being used in connection with indigo. It is a biennial shrub, with long leaves and small yellow flowers. The leaves are formed into a paste, and kept in heaps for a fortnight or longer, to ferment; are then formed into balls, dried in the sun, and subjected to another fermentation.

WOLF, *woolf* (Sax., *wulf*).—A variety (*Canis lupus*) of the *Canina* or dog family, of whose characteristics and general structure it strongly partakes. (*See* CANINA.) At one time the common wolf was a native of this country, and there was a period when its ravages were so great that the month of January was called by the Saxons the *wolf month*, because numbers of people, as well as cattle, sheep, and other animals, were devoured by flocks of them at that time of the year, and places of refuge from wolves were erected in lonely districts. Wolves became extinct in this country about the end of the 15th century; but in Scotland, they were numerous a hundred years later, and the last wolf is supposed to have been killed as late as 1680. In Ireland, there were wolves certainly thirty years after that date. The wolf is found at the present time in the northern portions of

Europe and Asia, residing principally in mountainous regions, whence it descends in pursuit of prey. In structure it is about the size of a large dog, but it is leaner and more gaunt in appearance. Its height is from two feet and a half to three feet, and its length varies between three and four feet. The colour of its coat is a mixture of black, brown, and gray, the hair being rough and hard, and mixed at the base with a sort of under-coat of ash-coloured fur. Its eyes have a most peculiar obliquity, which gives it a very fierce appearance, being directed upwards in a line with the nose, and the colour of the eyeballs being a fiery green, the ferocity inherent in the animal appears increased. The breath of the wolf is very offensive, and his flesh is said to be rejected by all other carnivorous animals, with the exception of those of his own species. The female goes fourteen weeks with young, and produces five or six cubs at a litter, which she tends and trains with the greatest assiduity for the space of some twelve months, after which she leaves them to shift for themselves. In disposition the wolf is a cruel, cowardly animal, generally attacking such as are unable to resist it; but when pressed by hunger, it will even attack man. Wolves generally hunt and pursue their prey in packs; and in hilly countries, where precipices abound, they often destroy far swifter animals than themselves, by encompassing them in a semi-circle, and driving them over some great declivity, where they are dashed to pieces. The wolves then descend by some path, and feast on their victims. Several varieties of the wolf are found in North America.

WOLF DOG.—A large dog formerly used in the north of Europe for hunting the wolf, but now only to be met with in Spain. It has a pointed nose, long silky hair, and a bushy tail curled over the back; the colour is white, with brown patches.

WOLFFIAN BODIES, *woolf'-fe-an.*—Organs in the embryos of vertebrate animals, in which they serve only a temporary purpose, except in the case of fishes, in which they are permanent. They may be regarded as temporary kidneys, which in the human embryo do not appear till the seventh week of gestation.

WOLF-FISH.—A genus (*Anarrhichas*) of fishes, the family *Blenniidæ*. (*See* BLENNIUS.) The Common wolf-fish (*A. lupus*), known also as the Cat-fish, or Sea-cat, is found on the British coasts. It is about six feet long, formidable in appearance, and of a savage nature, biting viciously when caught. The colour is light gray, brownish on the back, with twelve dark stripes on the lower parts. The flesh is eaten, especially in Scotland and Iceland, and the thick skin is manufactured into bags.

WOLF'S BANE. (*See* ACONITE.)

WOLVERINE, *wool'-ve-reen.* (*See* GLUTTON.)

WOMB, *woomb.*—The uterus of females; a pear-shaped organ, in which the embryo is developed until the time for birth. It is an organ peculiar to the Mammalia.

WOMBAT, *wom'-bat* (its native name).—A small bear-like marsupial quadruped known in New South Wales. It burrows like the badger, and does not quit its retreat during daylight.

WOOD, *wood.*—That portion of a plant which exists between the pith and the bark. (*See* TIMBER.)

WOODBINE. (*See* HONEYSUCKLE.)

WOODCHAT, *wood'-tchat.*—A bird (*Lanius rutilus*) of the Shrike family. It is very common in all parts of Africa, and in the European countries bordering on the Mediterranean, and is occasionally seen in this country. It is nearly 8 inches long, mostly black, but the under parts are white, and the crown of the head and back of the neck are chestnut.

WOOD-CHUCK, *wood'-tchuk.*—A burrowing animal (*Arctomys monax*), a species of marmot, a native of North America. It averages about 16 inches in length; the upper part is of a grizzly black colour, and the lower parts chestnut red; the tail is bushy. In winter it remains in its burrow in a torpid condition. In some districts it is popularly known as the Ground Hog.

WOODCOCK.—A game-bird (*Scolopax rusticola*), in great favour at the table. It is found in all parts of Europe and Northern Asia, and is one of the birds of Japan. It somewhat resembles the Snipe, with which it is commonly classed, but it is bulkier, and has shorter and stronger legs. It visits Great Britain in winter, and frequently breeds in the north of Scotland. In winter it frequents moist localities, in search of worms, snails, and other food, using its long bill to penetrate the soft ground. The bird is rather more than 12 inches in length. The upper parts are of varied red, yellow, and ash colour, with large black spots, and the lower parts yellowish red, marked with brown lines. The tail-feathers are brown above and white below. The female bird, which is larger than the male, carries her young from the nest to places where food may be obtained between her thighs, holding it close to her own body. The woodcock is sometimes caught in traps, but generally shot. There is a rather smaller American species.

WOOD-LOUSE.—A genus of crustacea (*Oniscus*), forming the family *Oniscidæ*, of the order *Isopoda*. The respiratory organs are covered by plates, the anterior ones having a row of small holes, through which the air reaches the gills. The Common wood-louse (*Oniscus murarius*) selects dark and damp places in holes of walls, under stones, and in the decaying bark of trees. When apprehensive of injury, it rolls itself into a ball.

WOODPECKER, *wood'-pek-ker.*—A genus of birds (*Picus*), of the family *Picidæ*, order *Scansores*. There are many species, but only four are found in Great Britain, the most common being the Green woodpecker, abundant also in most parts of Europe. The prevailing colour is dark green, tinged with yellow; but the crown and back of the head are bright scarlet, and the feathers over the nostrils and round the eyes are black. There is a bright scarlet patch near the beak, and the edges and tips of the wings are spotted black and white. They run and climb on the branches of trees in search of insects and larvæ, which they reach by the aid of a long flexible tongue covered with a glutinous saliva. The Great Black woodpecker, very rarely seen, is the largest of the British species, and is also found in the pine-forests of many parts of Europe. There are many American species of the woodpecker; and the bird is also abundant in South America, India, and the Eastern Archipelago.

WOODRUFF.—A genus (*Asperula*) of the natural order *Rubiaceæ;* annual and perennial plants found in the temperate and northern parts of Europe and Asia. The Sweet woodruff (*A. odorata*) is found in sheltered positions in woods. It has a creeping root and a stem from 6 to 10 inches long, and small white flowers. When dried, the plant emits a very agreeable fragrance. An herb tea is made from it, and it is used in preparing the "May drink" of Germany.

WOOD SORREL. (*See* OXALIDACEÆ.)

WOOD SWALLOW.—A genus (*Artamus*) of birds, natives of the East Indies and Australia, belonging to the family of Chatterers. The popular name is taken from the general resemblance of their habits to those of swallows. One Australian species has a strange habit of clustering, many birds together, on the branches of trees, like a swarm of bees, one bird clinging to another.

WORM, EARTH. (*See* EARTH-WORM.)

WORMS, INTESTINAL, *wurmz* (*Sax.*, *wyrm*, a worm).—Parasitical animals which infest the intestinal canal of man. They are of five different kinds,—the *Ascarides*, or small thread-worms, varying from an eigth of an inch to one and a half inch in length, and have usually their seat in the rectum, or last gut; the *Lumbrici*, or long round worms, from two or three to ten or more inches in length, and usually occupy the small intestines, and sometimes the stomach; the *Trichuris*, or long, hair-tailed thread-worm, occupying the cœcum; and the *Tænia*, or tape-worm. (*See* ENTOZOA, TAPEWORM, &c.) Worms appear most frequently in young children, and in those of a relaxed habit with weak digestive organs. An excessive use of fruit and vegetables, or sugar, or any other highly nutritive substance, favours the generation of worms. From the highly organized and sensitive parts which they occupy, worms give rise to great constitutional derangement, and produce a variety of symptoms, more particularly affecting the stomach and head.

WORMWOOD. (*See* ARTEMISIA.)

WRACK, OR SEA-WRACK, *rak.*—A popular name for many of the *Algæ*, of the seashores (*see* ALGÆ), but specially given to the species of the genus *Fucus* used in the manufacture of Kelp (*see* KELP), and as a manure.

WREN, *ren.*—A genus (*Troglodytes*) of birds of the *Centhiadæ*, or Creeper family. (*See* CREEPERS). They are natives of the northern parts of Europe, Asia, and America. The Common, or European wren (*T. Vulgaris*), common also in Asia, is a small bird about 4 inches long. The upper part is of a reddish-brown colour, with streaks of dark brown; the lower part yellowish white, the larger wing-coverts have a few white spots. It is a lively bird, and flits from one branch or bush to another, with great activity. Occasionally it climbs trees as the creepers do. The male bird has a loud song. It is a common belief with some rustics and children, that the wren is the female of the Robin redbreast—a very unfounded idea, although sanctioned by nursery rhymes about Cock Robin and Jenny Wren. The nest is large, and often placed under the thatch of cottages against the side of a moss-covered tree, or in some other sheltered place. There are many American species, the largest being the house wren (*T. ædon*), a bold bird, which takes forcible possession of the nests of other birds bigger than itself.

WRIGHTIA, *rite'-e-a.* (*See* APOCYNACEÆ).

WRITER'S CRAMP. (*See* PARALYSIS.)

WRYNECK, *ri'-nek.*—A genus (*Yunx*) of birds of the Woodpecker family. (*See* WOODPECKER.) The name is taken from its habit of turning the head and neck quickly with an undulating movement, if disturbed in its nest, making at the same time a hissing noise. The Common wryneck (*Y. torquilla*) visits this country and the north of Europe in the early summer, and from appearing at the same time as the cuckoo, is popularly known as the "cuckoo's mate."

X.

XANTHEINE, AND XANTHINE (Gr., *Xanthos*, yellow).—A term sometimes used to designate the colouring matter of various flowers.

XANTHORRHÆA, *zan'-tho-re-a.* — A genus of the natural order *Lilaceæ*. The species are natives of New South Wales, where they are commonly known as grass-trees. Their tops afford fodder for cattle, and their young leaves and buds are eaten as a table vegetable. Two fragrant balsamic resins are obtained from a species of this genus: the one is known as yellow resin of New Holland, or Botany Bay resin; the other as red resin of New Holland, or Black-boy gum.

XANTHOXYLACEÆ, *zan-thoks-e-lai'-se-e.*—A natural order of *Dicotyledones*, sub-class *Thalamifloræ*, closely allied to *Rutaceæ*. The plants are trees or shrubs, most abundant in the tropics, especially in America. They are generally characterized by pungent and aromatic properties, and have been employed medicinally as stimulants. They are popularly known as peppers in their native countries. In America they are also known under the name of prickly ash. The fruit of *X. piperitum* is employed by the Chinese and Japanese as a condiment, and as an antidote against all poisons. In commerce it is called Japanese pepper.

XYLOPHAGA, *zi-lof'-ag-a* (Gr., wood-eaters).—A family of *Coleoptera*, nearly resembling the Weevil. There are many species, some of which are very destructive to growing trees and timber.

XYLOPIA, *zi-lo'-pe-a.*—A genus of the natural order, *Anonaceæ*. *X. aromatica*, commonly known as *Piper æthiopicum*, has aromatic fruit, which when dried is used medicinally by the African negroes on account of its stimulant and carminative effects, and also as a condiment. *X. undulata* has nearly similar properties. *X. glabra*, yields the bitter-wood of the West Indies, which has tonic properties.

XYRIDACEÆ, *zi-ri-dai'-se-e.*—The *Xyris* family, a natural order of *Monocotyledones*, sub class *Petaloideæ*, consisting of sedge-like herbaceous plants found in tropical and sub-tropical regions.

Y.

YAK.—A species (*Bos grunniens*) of ox, a native of Tibet, where it is domesticated. The wild yak is of great size, and inhabits the mountainous regions, near the limits of perpetual snow, sometimes at an elevation of more than 1600 feet above the sea level. It is very fierce, and if attacked, endeavours to crush its opponent by throwing on him the whole weight of its body. It is covered with long silky hair, and the long flowing hair of the tail reaches to the hock. The most frequent colours are black and white, but there is considerable variety. The yak makes a short grunting sound, like that of a pig. The milk of the domesticated animal is of rich quality, and excellent butter is made from it, and the flesh, especially of the calves, is of fine flavour. The yak is commonly used as a beast of burden. The hair is spun into ropes, the fur on the hump and shoulders supplies material for a fine cloth, and the tails are employed in India as fly-flappers.

YAM. (*See* DIOSCOREA.)

YAPOCK, *ya'-pok.*—A marsupial quadruped (*Cheironectes palmatus*) of the Opossum family, inhabiting the tropical parts of South America. It is of a brown colour, with transverse gray bands, and in size rather larger than a rat.

YAWS. (*See* FRAMBOSIA.)

YELLOW BIRD.—A bird (*Chrysomitris*) of the Finch family, a native of North America. It is about five inches long. In summer, the male bird has a bright yellow plumage, with black crown, wings and tail white; but in winter it resembles the female, yellowish brown above and ashy brown in the under parts. It is a good cage bird, easily tamed, intelligent, and with a pleasing song.

YELLOW FEVER, *yel'-lo.*—A disease peculiar to warm countries, more particularly in low-lying districts near the sea-coast, and is of frequent occurrence on the east and west coasts of America, in the states bordering on the Gulf of Mexico, in the West Indies, and in Africa. The most marked characteristics of this disease are a yellowness of the skin, general or partial, and the vomiting of a black or dark-coloured fluid when about to terminate fatally; but these features are not always present. Otherwise it has the character of a common remittent fever. The mortality from this disease is always very great, more particularly among the young and robust; and hence it is very fatal among armies and navies. Its attack is sudden, but it is usually preceded by a feeling of weakness and restlessness, followed within a few hours with faintness, giddiness of the head, with a small degree of chilliness, and sometimes actual shivering. This is immediately succeeded by a high degree of fever. Sometimes the disease proceeds with fearful rapidity, and the patient is carried off in four-and-twenty hours.

YELLOW-HAMMER (German, *ammer*, a bunting).—A species (*Emberiza citrinella*) of Bunting, known also as the Yellow-bunting. (*See* BUNTING.) It is a well-known bird in nearly all parts of Europe, and very common in this country. It is about 7 inches long, and in summer the male is a very showy bird, of a bright yellow colour on the head, cheeks, and nape of the neck, with a few black patches; the upper part of the back and wings are reddish-brown, the latter having bright yellow edges; the upper tail-coverts chestnut, edged with yellow; the throat and under surface of the body bright lemon yellow, with in some places a reddish-brown tinge. The bird is generally seen in hedges and low trees; and makes its nest on the ground under shelter of a bush or tuft of grass. In Italy, yellow-hammers are caught and fattened for the table.

YEW. (*See* TAXUS.)

Y-MOTH, *wy'-moth.*—A beautiful species (*Plusia gamma*) of moth, which received the name from a bright mark on the wings, nearly resembling the letter Y of the English alphabet, or the gamma (γ) of the Greek. It is about an inch in length. The lower wings are nearly white, with a darker border, and a white fringe spotted with black.

YUCCA, *yuk'-ka.*—A genus of plants of the natural order *Liliaceæ*, of remarkable beauty, and on that account cultivated in gardens in its native countries, North and South America, and in Great Britain. One very fine species, *Yucca gloriosa*, has a stem nearly three feet high, and on the upper part is a thick tuft of large sword-shaped leaves, from the centre of which is a flower-stalk, more than three feet high, branching out on every side, and bearing bell-shaped and drooping flowers, white, with purple stripes. From the fibres of the leaves the Indians make cloth and cordage.

Z.

ZAMIA, *za'-me-a.*—A genus of plants of the natural order *Cycadaceæ*, common in tropical regions. It has a tree-like stem, the central part of which contains starch, and a preparation having some resemblance to sago is made from it.

ZAMOUSE, *za'-moose.*—A species of ox or buffalo (*Bos brachyceros*), a native of the tropical parts of Western Africa, and known at Sierra Leone as the Bush Cow.

ZEA. (*See* MAIZE.)

ZEBRA, *ze'-bra.*—A peculiar variety of the genus *Equus*, found in South Africa. To the figure and gracefulness of the horse it adds the elegance and swiftness of the stag, whilst its skin is as smooth as satin, and beautifully adorned with black and white bands, arranged with wonderful regularity and beauty. These bands are narrow, parallel, and exactly separated, and, unlike the quagga, extend not only over the body, but over the head, ears, thighs, and legs. In the female, they are black and white, but in the male they are black and yellow; but always of a brilliant tint, so as to enable them to stand out, as it were, from the coat. The ground-coat is composed of fine hair, which adds to the general effect by giving it a satin or velvety appearance. The zebra is closely allied to the ass, having its tail furnished with long hairs only at its tip, and being destitute of a mane like that of the horse. The Common, or Hill zebra (*Equus Zebra*), inhabits the rocky and mountainous districts of South Africa, and is rarely seen on level land. In disposition it is very wild and untameable.

ZEBU, *ze'-bu.*—A species of ox, a native of India, and commonly known as the Brahmin Bull. It differs from other species chiefly by the presence of a large hump, composed chiefly of fat, which attains a great size when food is plentiful. One breed has two humps. It is a very gentle, docile animal, and is used for draught, and as a beast of burden. A hybrid between the zebu and the yak is known as a zobo.

ZEDOARY, *zed'-o-a-re.*—An name given to some species of *Curcuma*, having aromatic and pungent root-stocks, which are frequently used in the east as a substitute for ginger.

ZENITH, *zen'-ith.*—An Arabic word used in astronomy, denoting the point of the heavens directly over the head of the observer. The zenith is called the "pole" of the horizon, as it is 90° distant from every point of that circle. The zenith distance of a heavenly body is the arc intercepted between the body and the zenith, being the same as the co-altitude of the body.

Zenith Sector.—An instrument which is a portion of a divided circle, and is employed in measuring the zenith distances of stars.

ZEOLITE, *ze-o-lit* (Gr., *zeo*, to boil).—A name given to a large class of minerals which melt at the application of the blow-pipe.

ZEUGLODON, *zoog'-lo-don* (Gr., *zeugos*, yoke; *odous*, tooth.)—A fossil tertiary mammal of the whale kind, so named by Professor Owen, from the peculiar form of its molar-teeth.

ZIMB.—An insect, a little larger than a bee, very destructive to cattle in Abyssinia. It also attacks the elephant, rhinoceros, and camel; but the two animals first named protect themselves by rolling in mud.

ZINGEL, *zin'-gel.*—A genus (*Aspro*) of fishes of the Perch family. Only two species are known, one found in the Danube, the other in the Rhone and eastern rivers of France.

ZINGIBER, *zin'-ji-ber.* (*See* GINGER.)

ZINNIA, *zin'-ne-a* (from Zinn, a German botanist).—A genus of plants of the *Compositæ* family, and a native of Mexico. There are about 12 species, the best-known of which is *Z. elegans*, a plant with many branches and showy flowers. By careful cultivation, double flowers, resembling dahlias, have been obtained.

ZIRCONIUM, *zir-ko'-ne-um.*—The metallic basis of the earth zirconia, contained in the rare minerals zircon and hyacinthon, which are silicates of the earth.

ZIZYPHUS, *ziz'-i-fus.*—A genus of the natural order *Rhamnaceæ.* Many of the species have edible fruits; thus *Z. vulgaris*, *Z. Jujuba*, and others, yield the fruits called jujubes; *Z. Lotus*, the fruit supposed to be the lotus of the ancients, from which the Lotophagi received their name. The latter is much esteemed by the Arabs.

ZODIAC, SIGNS OF THE, *zo'-de-ak* (Gr., *zodia*, animals, because the constellations comprising it are represented under the figures of animals).—In Astronomy, the planets all make their revolutions within an imaginary ring or belt in the heavens, which cuts the equator obliquely, and makes with it the same angle as the ecliptic. The zodiac is divided into twelve equal parts, of thirty degrees each, which are called the *signs of the zodiac*, being so named from the constellations which old astronomers named, Aries, the ram; Taurus, the bull; Gemini, the twins; Cancer, the crab; Leo, the lion; Virgo, the virgin; Libra, the balance; Scorpio, the scorpion; Sagittarius, the archer; Capricornus, the goat; Aquarius, the water-bearer; Pisces, the fishes.

ZODIACAL LIGHT, *zo'-di-a-kal.*—A peculiar luminosity seen at all seasons in tropical regions, before sunrise and after sunset, but in this country only in spring and autumn. It appears to be due to luminous matter (partly, it is conjectured, self-luminous) surrounding the sun in a flat form, and extending to a distance from the sun greater than that of the earth.

ZONE, *zone.* (*See* PHYSICAL GEOGRAPHY.)

ZOOLOGY, *zo-ol'-o-je* (Gr., *zoon*, an animal, and *logos*, a discourse).—That part of natural history which treats of the structure, habits, and habitations of all animals, from man to the humblest animalcule. We find that a general plan or system underlies the innumerable diversiform beings included in the first kingdom of nature. To discover this plan has always been the highest object of the scientific naturalist, and the many beautiful schemes of classification which have been devised are the results of investigations undertaken with this view. A very cursory inspection of the forms and structures of the different tribes of animals which are constantly presenting themselves to our notice, might satisfy us, that amongst all there are resemblances and differences; between some the similarity being the prevailing feature, whilst between others the differences are most obvious In a crude shape, zoological classification must have been employed by the earliest human inhabitants of the globe. The first observers of nature must have seen that animals could be placed in natural groups, as the distinctions between quadrupeds, birds, fishes, and insects, are very obvious. Minor divisions must also have been made at a very early period; for instance, the division of beasts into herbivorous and carnivorous groups, and of birds into granivorous and carnivorous. Until the time of Aristotle, who has justly been termed the father of natural history, zoological classification was based upon obvious external characters, and was necessarily very imperfect. Aristotle's system was the first founded on the only sure basis—the organization or physiological character of each animal. His method has been followed by all his successors, but we need scarcely say that his classification no longer holds a place in zoology. Between the systems of Aristotle and Linnæus, those of Ælian, Pliny, Athenæus, Albertus Magnus, Belon, Gesner, Aldrovandus, Johnston, Ray, and Buffon, were successively introduced; but all these have long since been discarded. By Linnæus the animal kingdom was arranged in six great classes: namely, *Mammalia* (sucklers), *Birds*, *Amphibia* (reptiles), *Fishes*, *Insects*, *Vermes* (worms). The Linnæan system gave place to that of Cuvier, which is now generally followed with some modification. By Cuvier the animal kingdom was divided into four sub-kingdoms—*Vertebrata*, *Mollusca*, *Articulata*, and *Radiata*. Recent authorities have, however, divided it into five sub-kingdoms, by splitting the Radiata into two, and rearranging some of its constituents.

Cuvier's Classification.—*Vertebrata.*—The animals of this sub-kingdom are characterized by the presence of a back-bone and bony skeleton. The blood is red, the heart muscular, and the mouth is furnished with two jaws, placed one either before or above the other. They have distinct organs of sight, hearing, and smell, situated in the cavities of the face, and they have never more than four limbs. The sexes are always distinct. In the nervous system we distinguish two great centres of power, the brain and spinal cord. In the other three sub-kingdoms, which may be grouped together under the general head of *Invertebrata*, we place all animals void of backbone and bony skeleton. *Mollusca.*—The animals belonging to this great group have no internal skeleton, the muscles being attached only to the skin, which constitutes a soft contractile envelope. The nervous system is contained within this general envelope, together with the viscera, and is composed of several scattered masses connected by nervous filaments. Of the four senses, only those of taste and vision can be distinguished, and the latter sense is frequently wanting. Snails, slugs, oysters, and muscles, are molluscuous animals. *Articulata.*—The nervous system of the third type of animal life consists of two long cords running longitudinally through the abdomen, dilated at intervals into knots, or ganglia. The organs of taste and vision are usually well developed. The envelope of the trunk is divided by transverse folds into a certain number of rings, to the interior of which the muscles are attached. The trunk often bears on its sides articulated limbs, but is frequently unfurnished with them. Worms and insects are included in this sub-kingdom. *Radiata.*—In the radiate type the organs of sense and motion, instead of being arranged symmetrically on two sides of an axis, are disposed in rays round a centre. There is no very distinct nervous system, nor are there any organs of particular senses. This sub-kingdom embraces all those animals known as zoophytes, the star-fishes, and other lowly forms of life.

ZOOPHYTES, *zo'-o-fites* (Gr., *zoon* an animal, and *phuton*).—A class of marine animals classed by Cuvier in the division *Radiata*, including many organizms that are fixed to a definite spot, and have the form of plants. Scientific naturalists never now employ the name.

ZYGOPHYLLACEÆ, *zi-go-fil'-lai-se-e.*—The Bean-caper or Guaiacum family, a natural order of *Dicotyledones*, sub-class *Thalamifloræ*, herbs, shrubs, or trees. The plants of the order are generally distributed throughout the warm regions of the globe, but chiefly beyond the tropics. (*See* GUAIACUM.)

ZYMOTIC DISEASES, *zi-mot'-ik* (Gr., *zumoo*, I ferment).—A designation applied to diseases which are epidemic, endemic, or contagious, as well as such as result from the scarcity and the deterioration of the necessary kinds of food, or from parasitic animals. They are divided into four orders—miasmatic, enthic, dietic, and parasitic, of which, fever, syphilis, scurvy, and worms may be taken as the respective types. In this country, the deaths from zymotic diseases amount to nearly one fourth of the total number of deaths.

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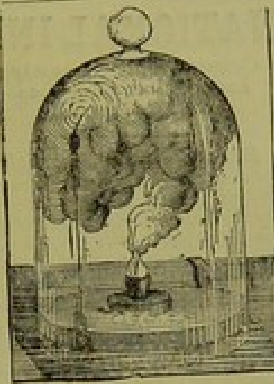

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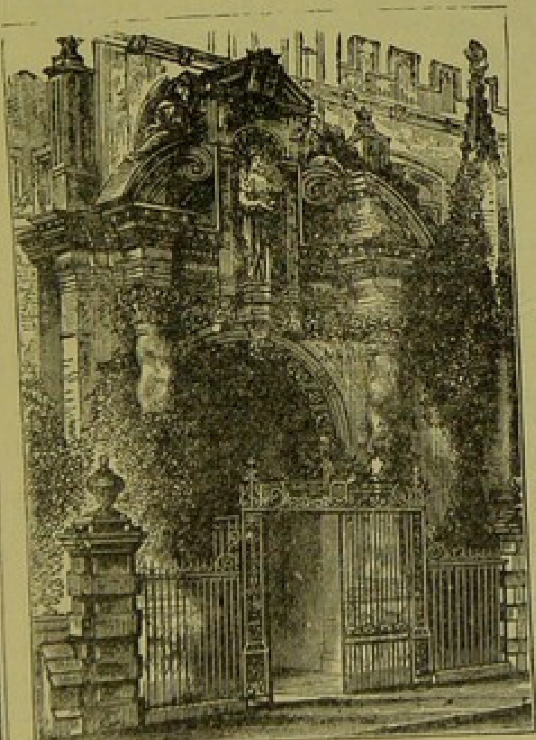

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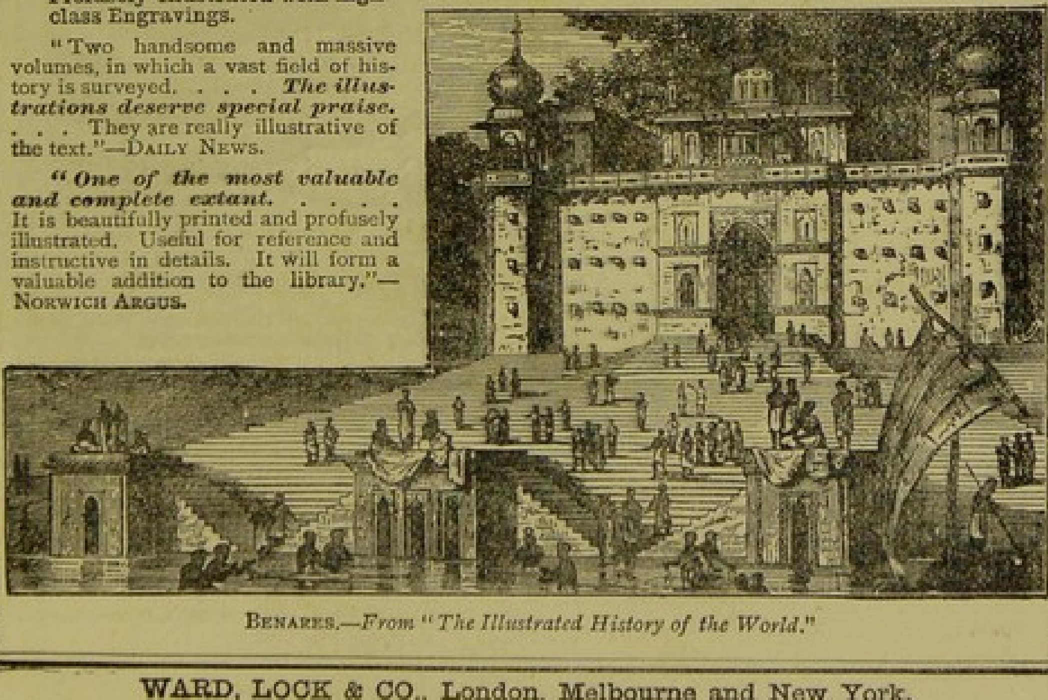

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