VETERINARY MEDICINES:

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BY

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PREFACE.

DURING the four years in which I have lectured on Materia Medica at the Edinburgh Veterinary College, I have endeavoured in vain to find a suitable text-book for my class. The meagreness and inaccuracies of the published works on veterinary medicines are such as to have compelled me to use Christison's Dispensatory, or some other of the excellent works on human Materia Medica. But although such text-books furnish the veterinary student with a knowledge of the preparation, properties, and adulterations of medicines, they necessarily contain a considerable amount of matter of comparatively little importance to him; and they further afford him no information concerning the general actions, uses, and doses of medicines when administered to the various domesticated animals. A text-book, specially designed for veterinary students, is therefore a desideratum, and I have endeavoured to supply it by the publication of this volume.

The contents and arrangement of the work are as follows. The general actions and uses of veterinary medicines, and the more important pharmaceutical preparations, are treated of in the Introduction. The rest of the volume is occupied with the consideration of the medicines used in veterinary practice; the points chiefly dwelt upon being their natural history, preparation, properties, and most common impurities and adulterations; their general actions on the various domesticated animals; and their uses, doses, and medicinal forms. The several drugs are discussed in alphabetical order according to their English names. Other arrangements of a more scientific nature might have been adopted. The articles of the Materia Medica might, for example, have been classified, as has been done by Pereira and others, according to their natural history relations,—the vegetable substances being grouped under the natural families to which they belong; the mineral, according to their chemical affinities. But such an arrangement, while conveniently associating medicines with similar external characters, and similar actions, requires for its satisfactory study a considerable knowledge of botany and chemistry, and is, besides, somewhat defective on account of the botanical relations of certain plants, and the chemical relations of certain drugs, being as yet insufficiently ascertained. On the other hand, some authors and lecturers discuss medicines according to their general actions; but such a method, though possessing certain practical advantages, frequently necessitates the consideration of the same medicine under several different heads. These systems being thus objectionable, I have preferred an alphabetical arrangement as the most convenient, especially in a work of reference.

From the detailed manner in which the actions, uses, and doses of medicines are considered, and from the original matter introduced regarding aconite, tartar emetic, and other drugs, I trust that the volume may be found useful not only to students as a text-book, but also to practitioners as a book of reference. From its practical nature, it may further be serviceable to agriculturists and others who are in the habit of treating simple and incipient cases of disease without professional aid.

The works which I have chiefly consulted in the preparation of this volume are,—Professor Christison's "Dispensatory" and "Treatise on Poisons;" the late Professor Pereira's "Elements of Materia Medica;" Mr Headland's "Essay on the Actions of Medicines"—being the Fothergillian Prize-Essay for 1852; the "Edinburgh Pharmacopœia;" Professor Hertwig's "Praktische Arzneimittellehre für Thierärzte," Berlin; and Moiroud's "Traité Elémentaire de Matière Médicale ou de Pharmacologie Vétérinaire," Paris and Toulouse.

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INTRODUCTION.

Veterinary Materia Medica, in the extended sense of the term, treats of every agent, material or immaterial, which is used for the cure of disease or injury, or for the preservation of health among the domesticated animals. The subject may be divided into two parts—Zoötherapeutics and Zoöhygienics.

Zoötherapeutics (ζῶον, *zōon*, an animal; and θεραπεύω, *therapeuō*, I cure) treats not only of the material substances used in veterinary practice, as drugs or medicines properly so called, but also of all the immaterial or imponderable agents, as heat, light, and electricity, and all the mechanical and surgical remedies which the practitioner has occasion to call to his aid. It also includes Veterinary Pharmacy, which consists in the collection, preparation, preservation, and dispensation of veterinary drugs.

Zoöhygienics (ζῶον, *zōon*, an animal; and ὑγιεινός, *hügieinos*, healthy) treats of all that affects the sanitary condition of animals. It includes dietetics, and inculcates the best modes of maintaining warmth, cleanliness, and efficient ventilation in the houses and sheds intended for the accommodation of stock.

But as the full discussion of Veterinary Materia Medica under these two divisions, would require a treatise far exceeding the limits of the present work, it is my intention to confine my observations solely to that branch of the first part of the subject which is sometimes styled Veterinary Pharmacology, or the description of the medicines or drugs used in the cure of disease among the domesticated animals.

As, however, the different medicines thus used possess many actions in common, and are prepared by the same pharmaceutical processes, I purpose prefacing the consideration of individual medicines by a few remarks on the general actions of medicines, and on the more important operations of pharmacy. These subjects will be discussed in the two following sections.

SECTION I.

ON THE GENERAL ACTIONS AND USES OF MEDICINES.

Every medicine is endowed with certain inherent characteristic actions, which distinguish it as decidedly as its physical and chemical properties. Thus, some medicines act on the bowels, causing purgation; others on the kidneys, stimulating the secretion of urine; and others on the brain and nervous system, causing insensibility; in fact, there is no part or organ of the body, except the spleen and pancreas, which is not influenced, and that often in several different ways, by some medicinal agent. It is impossible, however, to explain why a medicine should act in one way rather than in another; why, for example, aloes is purgative, and not diuretic, narcotic, or anæsthetic; or why chloroform is anæsthetic, and not vesicant, diuretic, or purgative. The student must therefore endeavour to conceive of these actions, or dynamical effects of medicines, in the same manner as he does of their more familiar properties of colour, odour, taste, or density.

In order to facilitate the discussion of the general actions and uses of medicines, I shall divide this section into the following heads:—

I. The manner in which medicines establish their actions.

II. The manner in which medicines are believed to cure disease.

III. The arrangement of medicines according to their physiological actions.

IV. The circumstances which modify the actions of medicines.

I.—THE MANNER IN WHICH MEDICINES ESTABLISH THEIR ACTIONS.

Some medicines, as demulcents, caustics, and astringents, have merely a local or topical action—soothing, irritating, corroding, or altering the animal tissues, but not extending their influence beyond the part to which they are first applied. Others, either with or without such a local effect, have a remote or indirect action on organs at a distance from the part with which they are first brought in contact. Medicines which act thus remotely or indirectly are thought to produce their effects in either or both of the two following ways:—(*a*) They are absorbed into the circulation, and carried by the blood to remote organs; or, (*b*) The impression, which they produce on the parts with which they are first brought in contact, is transmitted along the nerves to other parts. The latter mode of operation is sometimes called action by sympathy.

(*a*.) The great majority of medicines appear to act in the former of these two ways, being taken up by the blood-vessels from the surface of the mucous membranes, skin, or other part to which they have been applied. Thus, most medicines given by the mouth, after having, if solid, undergone solution in the acid gastric juice or alkaline bile, pass, by a process of endosmose, into the capillary veins which ramify on the surface of the stomach and intestines, enter the general circulation by the mesenteric and portal vessels, and are thus carried to all parts of the body, altering, it may be, the nutritive processes of various organs and tissues, and at length expelled through some of the excretory channels, as the skin, kidneys, or bowels. The rapidity with which most substances are thus absorbed and make the round of the circulation is almost incredible. Professor Hering, of the Veterinary College, Stuttgardt, found that yellow prussiate of potash injected into one of the jugular veins of a horse appeared in the other in twenty-five seconds, and was exhaled from the mucous and serous membranes in a few minutes; and also that chloride of barium injected into the jugular vein of a dog reached the carotid artery in seven seconds. Dr Blake observed that chloride of barium and nitrate of barytes traversed the whole circulation of a dog in nine seconds, and that of a horse in twenty seconds; and a similar rapidity of distribution doubtless obtains with substances which cannot easily be detected in the blood.

(*b.*) The other hypothesis, regarding the action of medicines, is that they owe the development of their effects to the production of some nervous impression on the part to which they are first applied, and its subsequent transmission to remote organs by means of the nervous system. A recent modification of this theory, advanced by Messrs Morgan and Addison, assumes that the nervous impression is produced, not upon the part with which the medicine is first brought in contact, but on the interior of the blood-vessels after partial absorption. Part of the evidence in support of these hypotheses is derived from the fact that some poisons operate with such extreme rapidity as to render it doubtful whether there could be time for their being absorbed and making the round of the circulation. Thus anhydrous prussic acid, conia the alkaloid of hemlock, and aconita the alkaloid of aconite, when injected into the veins, applied to the cellular tissue, or given by the mouth, produce almost instantaneous effects, and death in a few seconds. It appears, however, that the strongest evidence in favour of the theories under consideration consists in the effects of local injuries in producing constitutional disturbance. For example, a blow on the region of the stomach sometimes causes fatal swooning; distention of the stomach often produces hiccough; the presence of worms in the intestines sometimes induces epilepsy; and a local injury frequently causes fever and constitutional disturbance of all the more important organs of the body. In such cases the connection between cause and effect obviously depends on the transmission of nervous impressions only. And if topical causes are thus productive of remote effects, it is surely fair to infer that medicines and poisons may operate in a similar manner.

In fine, although it would appear that most medicines are absorbed, and actually conveyed to the parts on which they act, and that such absorption and actual contact are essential to their action, yet it is highly probable (though not yet positively ascertained) that some substances, especially the more active poisons, astringents, and emetics, owe their effects to the production of a nervous impression, and its propagation to remote organs. Nor is it at all improbable that, under different modifying influences, certain substances will operate sometimes in one and sometimes in the other of these two ways.

II.—THE MANNER IN WHICH MEDICINES ARE BELIEVED TO CURE DISEASE.

Every medicine, as already stated, is possessed of certain inherent and distinctive dynamical effects, which are exerted both in health and disease, and are termed its *physiological* actions. When, however, appropriate medicines are administered for the treatment of any curable disease, they are said to call forth another and secondary series of actions more variable, uncertain, and limited than the physiological, but springing from them, and leading directly to the mitigation or cure of the malady. These are usually called *therapeutic* or *curative* actions, and may perhaps be better understood from the following illustrations:—A dose of aloes, or of any other purgative, administered during a simple febrile attack caused by the presence of irritating matters in the intestines, induces, first, its usual physiological effect, namely, purgation; this removes the cause of irritation, or excites the so-called therapeutic action, and is hence succeeded by restoration to health. Again, a diuretic given in a case of simple anasarca, or watery effusion in dependent parts, usually establishes, in virtue of its primary or physiological effect of increasing the secretion of urine, a secondary or therapeutic action, namely, the draining away of the effused fluid, and the consequent cure of the case. With some medicines it is not difficult to trace the cure, first to the therapeutic, and then to the physiological action, and to note each stage distinctly; with many others, however, it appears impossible, even with the utmost care and ingenuity, to discover any properly marked difference between the physiological and therapeutic actions on the one hand, and the therapeutic actions and the cure on the other. Indeed, there appears little use for complicating our ideas of the actions of medicines by regarding them as two-fold; for a physiological action, more or less obvious, is the source and origin of every cure, while the so-called therapeutic action is merely the physiological action exercised in or modified by disease, and specially applied to its alleviation or removal.

Many hypotheses have been propounded in explanation of the manner in which medicines cure disease. But the two which are most deserving of credit, and which together appear sufficient to account for the action of most, if not all, medicines are,—1st, The *antipathic;* and 2d, The *allopathic* mode of cure.

1st. Medicines act antipathically (ἀντί, *anti*, opposite; and πάθος, *pathos*, a disease), or, in other words, they produce a condition diametrically opposed to the disease in which they are administered. It is thus that astringents are effectual in diarrhœa; purgatives in torpidity of the bowels; and stimulants in depressed states of the system. In these, and in all other cases where an antipathic cure is effected, the physiological action of the medicine overcomes the morbid condition, because it counteracts it by a superior and directly antagonistic force. This mode of cure is specially adapted to the treatment of symptoms and local diseases.

2d. Medicines act allopathically (ἄλλος, *allos*, another; and πάθος, *pathos*) or produce an effect, which, though itself unnatural, overcomes the disease to be cured; or, in other words, they occasion a short, simple, and manageable disease, which subdues that which originally existed. Nature herself frequently removes maladies in this way. Thus a spontaneous diarrhœa often relieves internal congestions; and copious perspiration, febrile attacks. In a similar manner blisters relieve pleurisy, purgatives alleviate local inflammation, and diuretics drain away œdema or dropsy.

But about sixty years ago another method of cure was propounded by the German physician, Hahnemann, who taught that the cure of a disease is effected by the administration, in small doses, of such medicines as would, when given to a healthy subject in large quantity, induce the same disease. This is the doctrine of homœopathy (ὅμοιος, *homoios*, like or similar; and πάθος, *pathos*), the principles of which are enunciated in the aphorism, *similia similibus curantur*. According to this doctrine, cinchona cures ague and intermittents, because it produces such febrile symptoms when given to healthy individuals in considerable doses; aconite is the appropriate remedy for reducing inflammatory fever, because in large doses it produces that condition; and strychnia is the best remedy for palsy, because in large doses and in healthy subjects, it produces that disease. But this law of similars, as the homœopathists phrase it—a law on which the whole system is said to be founded—is unsupported by adequate facts and arguments, and is quite insufficient to account for the action of most remedies. Oil of turpentine destroys lumbrici and other intestinal worms; but no one will assert that it is capable of producing such parasites in what doses soever it may be given. Sulphur is notoriously one of the best remedies for removing lice and many skin diseases, but does not produce either. Arsenic, iodine, and belladonna, are the homœopathic remedies for thick wind; yet none of these, nor even all of them together, produce thick wind. Aurum, arsenicum, bromine, and various other substances, are given in glanders, farcy, and consumption; yet none of these, nor, indeed, any other medicine, is known to cause any such complaints. Even cinchona—one of the most favourite illustrations of the homœopathic axiom, and that which first led Hahnemann to the discovery of the so-called universal and infallible law—does not cause, in the great majority of cases, any symptoms at all analogous to fever, and never produces the intermittent fever which characterises ague. Lemon juice cures but does not produce scurvy. Iodine removes glandular enlargements, but does not cause anything at all analogous to them. Aconite, when given in allopathic doses, reduces the pulse and counteracts inflammation, but fails entirely to cause plethora or inflammation in healthy individuals. Numerous other examples, equally pertinent, might be given, showing as clearly as possible, that the so-called facts, on which the whole system of homœopathy is based, are no facts at all. Any deductions or generalisations drawn from these facts must therefore, of course, be quite untenable. Were the doctrines of Hahnemann sound and true, all medicines which cause symptoms similar to any particular disease must, in certain small doses, be safe and effectual for curing that disease. But this is certainly not the case. Purgatives cause diarrhœa, but do not usually check it; diuretics cause diuresis and inflammation of the kidneys, but do not stop either; and in the same way it might be said that alcohol should cure intoxication because it causes it!

If the principles or foundations of homœopathy be false and imperfect, as I have endeavoured to show, the superstructure based on such a foundation cannot be otherwise than weak and tottering. The following important facts and doctrines of homœopathy, exhibit more clearly than any arguments, the extravagancies and inconsistencies of the system:—The homœopathic doses are so small that they are often undetectible either by the microscope or by chemical analysis, and are sometimes so inconceivably minute that the mind can form no idea of them. It is admitted, even by homœopathists, that millions of such doses may be swallowed by a healthy individual without inconvenience, but in disease the system is believed to become so susceptible of their action, that much risk is incurred by their insufficient dilution. Medicines, such as charcoal, sand, and carbonate of lime, which, in ordinary doses of several scruples or drachms, have only a slight mechanical effect, when given in fractional parts of a grain, are thought to produce very powerful effects and cause many hundred symptoms. Charcoal, for example, is said, when given to man in very minute doses, to produce 930 distinct symtoms; oyster shell, 1090 symptoms; and the ink of the cuttle-fish, 1242 symptoms. The extraordinary powers supposed to be conferred on these and other medicines, even when given in doses of inconceivable minuteness, are chiefly ascribed to the magic influence of careful and continued triturations and often repeated shakings, performed according to most precise directions. Little difference of activity is believed to exist between different dilutions of the same medicine; and it is said, that if the medicine be well selected, it matters little whether the tenth, hundredth, or thousandth of a grain be used. There is probably some truth in this observation; for, with most medicines, especially when administered to the lower animals, all the dilutions mentioned would be equally harmless. The admixture of different medicines with one another, is said to neutralise the effect of all; but, if this be the case, homœopathic drugs must always be without effect (which is very probable), for all medicines contain adulterations and impurities, which, though small in amount, must of course acquire great potency by the triturations above mentioned.

But homœopathists assert that, in spite of the errors which their opponents discover in the system, it is nevertheless very successful in the cure of disease. In judging, however, of homœopathy as a system of practical medicine, it must ever be regarded as made up of two distinct parts—1st, The original and peculiar part of the system, consisting in the use of medicines selected in accordance with a law embodied in the axiom *similia similibus curantur*, and administered in infinitesimal doses, usually varying from one grain to one-millionth of a grain, and carefully prepared according to certain precise directions; and 2d, Attention to diet and regimen—the only effectual and rational part of homœopathy—the true source of all its boasted cures—and that very department of medical treatment which has been insisted upon from the most ancient times by all scientific and successful practitioners, both of human and veterinary medicine. The value of the first part of the treatment, viz., of medicines given homœopathically, has never been satisfactorily shown, and never can be so, until two series of cases, as nearly as possible alike, be treated, the one in the usual homœopathic fashion, the other with the same attention to diet and regimen, but without the globules. If, in a sufficient number of well regulated experiments, the former method proves itself superior to the latter, then of course it would be fair to infer that the medicine had some real curative effect. But no such superiority has been observed where impartial observations have been made. In a few experiments made at the Edinburgh Veterinary College, as to the treatment of pleuro-pneumonia and other diseases according to these two modes of cure, it appeared, that those cases which were treated by diet and regimen alone were as speedily and effectually cured as those treated with the globules in addition, so long as these globules were given in homœopathic doses. I say, so long as the doses given were homœopathic; and this, I think, is an important fact; for many of the medicines, which are used homœopathically, are, in ordinary medicinal doses, capable of producing prompt and often powerful effects, and become effectual means of cure, in virtue of their physiological properties, but not in virtue of any homœopathic action.

But though the principles of homœopathy are unsound, and though its practice among the lower animals has not been more successful than that of many more modest modes of treatment, still it has done some service to the cause of practical medicine, by showing more forcibly than before the great power of the *vis medicatrix naturæ*, and the inestimable importance of regimen and diet as auxiliaries to the medical treatment of disease. Further, it has aided in the advancement of a more rational system of veterinary practice, by discountenancing those copious and repeated bleedings, and large and reiterated physickings, which were often indiscriminately prescribed for all patients; and it has also acted beneficially in elucidating various subjects connected with therapeutics, and in inducing the opponents, as well as the supporters of homœopathy, to institute numerous and careful observations on the actions of remedies both on man and the lower animals.

III.—THE ARRANGEMENT OF MEDICINES ACCORDING TO THEIR PHYSIOLOGICAL ACTIONS.

The comparatively obvious nature, regularity, and certainty of the physiological actions of medicines, render these a valuable means of arranging or classifying the different articles of the materia medica; and it is found that the arrangements or classifications so made, though confessedly imperfect, on account of our present defective knowledge of therapeutics, are of much practical utility. I have, therefore, subjoined a tabular view of a physiological classification which I have sometimes adopted in my lectures, and in which I have grouped medicines, classed and denominated according to their physiological actions, into three great divisions of mechanical, chemical, and vital agents—a plan followed by Dr A. T. Thomson and many other authors.

TABLE OF THE DIFFERENT CLASSES OF MEDICINES, ARRANGED ACCORDING TO THEIR PHYSIOLOGICAL ACTIONS.

I.—MEDICINES WHICH ACT CHIEFLY AS MECHANICAL AGENTS.

	Agents which	Examples :—
Demulcents.	Protect the tissues from the action of irritants.	Solutions of gum, albumen, and gelatine.
Diluents.	Dilute the fluids.	Water, and mild watery fluids.

II.—MEDICINES WHICH ACT CHIEFLY AS CHEMICAL AGENTS.

	Agents which	Examples :—
Antiseptics.	Prevent or arrest putrefaction.	Common salt, spirits, tannin.
Disinfectants.	Absorb, alter, or destroy contagious matters.	Chlorine, sulphurous acid, ozone.
Antidotes.	Counteract poisons.	Dilute alkalies for acids. Hydrated sesquioxide of iron for arsenic, etc.
Caustics.	Destroy the animal solids, and decompose the fluids.	Strong acids, metallic salts, as nitrate of silver, butter of antimony.
Acids.	Counteract alkalinity.	Sulphuric, nitric, and hydrochloric acids.
Antacids.	Counteract acidity.	Alkalies and alkaline earths.

III.—MEDICINES WHICH ACT CHIEFLY AS VITAL AGENTS.

		Agents which	Examples :—
Agents which increase local action.	Rubefacients.	Cause redness of the skin.	Alcohol, turpentine.
	Vesicants.	Cause discharge of serum from the skin.	Cantharides, boiling water.
	Suppurants.	Cause discharge of pus from the skin.	Croton oil, Tartarised antimony.
	Errhines.	Irritate the mucous membrane of the nostrils.	Veratrum album, euphorbium.
	Stomachics.	Promote digestion.	Ginger, cardamoms, volatile oils.
	Emetics.	Cause vomiting.	Tartarised antimony, sulphates of zinc and copper, common salt.
	Ecbolics.	Induce contractions of the uterus, and expulsion of its contents.	Ergot of rye, savin, cantharides.
	Aphrodisiacs.	Stimulate the generative organs and the venereal appetite.	Phosphorus, cantharides peppers.

Agents which increase local action and secretion.	Cathartics.	Evacuate the bowels.	Aloes, croton, oils, jalap.
	Expectorants.	Increase the secretions of the respiratory mucous membrane.	Ipecacuan, balsams, gum-resins.
	Diaphoretics.	Increase the perspiration.	Warm clothing, acetate of ammonia, ethers.
	Diuretics.	Increase the secretion of urine.	Turpentine, resin, nitre.
	Sialogogues.	Increase the salivary secretions.	Mercurials, iodine, pungent-tasted bodies.
Agents which increase general action.	Tonics.	Improve the appetite and increase the general vigour.	Cinchona, quinine, sulphates of iron and copper.
	Calefacients.	Stimulate the circulating system.	Volatile oils, ammonia, alcohol.
	Nerve stimulants.	Stimulate the nervous system.	Nux vomica, large doses of calefacients.
Agents wh. incr. both general and local action.	Astringents.	Constrict muscular fibre.	Oak bark, tannin, alum.
Agents which dim. local action.	Emollients.	Soften the tissues.	Poultices, fomentations, Moistened spongiopiline.
	Refrigerants.	Lower animal heat.	Cold air, cold water, ice, saline and etherous matters.
Agents which diminish general action.	Sedatives.	Depress both the circulatory and nervous systems.	Aconite, prussic acid, digitalis.
	Narcotics.	Pass from the blood to the nerves and nervous centres, and act so as first to exalt nervous force and then to depress it; and have also a special action on the intellectual part of the brain. (Headland.)	Opium, Indian hemp, belladonna.
	Anæsthetics.	Diminish sensibility to pain, and to external impressions.	Chloroform, ether, naphtha, coal gas.

To familiarise the student with the names, general actions, and therapeutic applications of these different physiological classes of medicines, I shall briefly notice them in the order in which they occur in the above table.

DEMULCENTS.

Demulcents (*demulceo*, I soften) sheath and protect the tissues from irritants. Gums, mucilage, sugar, starchy matters, gelatine, albumen, fats, and oils, as well as cotton, thin leaves of gutta percha, and oiled silk, are familiar examples of this class of remedies. They are chiefly used to take the place of the natural demulcents, as the tears, mucus, or skin, where these are defective or wanting; to defend external sores from the injurious action of the air, or of acrid secretions; and to lucubrate the mucous membranes, and protect them from irritating and poisonous matters.

DILUENTS.

Diluents (*diluo*, I dilute) are a very simple class of medicaments, consisting of bland watery fluids which (as the name indicates) dilute the blood and the watery secretions. They include all simple drinks, and owe their action to the water which they contain. They are prescribed in febrile attacks, to promote the action of the various secretions; in inflammation of the urinary organs, to dilute the urine, and lessen its irritant effects; and in innumerable cases, to facilitate and expedite the action of purgatives, diuretics, and other evacuants.

ANTISEPTICS—ANTIPUTRESCENTS.

Antiseptics (ἀντί, *anti*, against; and σηπτικός, *septikos*, putrifying) prevent or arrest putrefaction. This class of medicines includes chlorine and its compounds, sulphurous acid, and sulphite of soda, the mineral acids, arsenious acid, common salt, astringent metallic salts, vegetable substances rich in tannin, sugar, spirits, creasote, and pitch oil. Antiseptics check that slow breaking up of organised bodies, which is termed putrefaction, by removing some or all of its causes. A few antiseptics, as sulphurous acid, and sulphite of soda, act by excluding oxygen, or air, which is essential to the establishment of putrefactive change; whilst most of the others above mentioned, abstract water and combine with the tissues, forming compounds which are insoluble, and consequently little liable to decay. Antiseptics are used for preserving meats, and anatomical preparations, and occasionally for arresting caries and gangrene. They were at one time given internally, in the belief that they counteracted general putrescency of the solids and fluids. But they are not now administered for such purposes, as it is well known that putrefaction never occurs except in such organised matter as has passed beyond the pale of vitality.

DISINFECTANTS.

Disinfectants (*dis*, signifying separation ; and *inficio*, I infect), as above defined, are agents which absorb, alter, or destroy contagious miasmata. Their *modus operandi* is necessarily somewhat obscure and unsatisfactory, for it is not as yet known in what the matter of contagion consists. Air from fever wards and other places filled with men and animals suffering from diseases of a notoriously contagious kind, has been carefully examined ; but the poisonous material, which such air undoubtedly contains, has hitherto entirely escaped detection. It is not as yet definitely ascertained whether it occurs in a gaseous, fluid, or solid condition. Until recently, the current opinion was favourable to the view of its being a gas ; and accordingly many gases were singled out as the essential causes of contagious disorders, as, for example, carbonic acid, sulphuretted hydrogen, hydrosulphuret of ammonia, seleniuretted hydrogen, and light carburetted hydrogen. But these gases have not been found in undue amount in the atmosphere in which patients affected by contagious diseases have been kept, and may, moreover, when mixed with air, be breathed in sensible, and sometimes even considerable quantities, without producing such diseases. One of the most recent hypotheses regarding the production of these diseases, ascribes them to a peculiar principle called ozone, discovered by Professor Schönbein, and believed to be an allotropic modification of oxygen, or an oxide of hydrogen, or, according to Dr Stevenson Macadam, an oxide of nitrogen. But contagious disorders do not appear to be developed by thunder-storms or other electrical disturbances of the air, during which, however, ozone is abundantly evolved; nor do they specially attack those employed in working friction or hydro-electric machines, even when these are of large size, and are worked for several days with constant evolution of large quantities of ozone distinctly perceptible to the nostrils. Indeed, ozone, so far from being a cause of disease, has been suggested by Dr George Wilson, as being a most valuable preventive of disease, as being, in fact, the natural disinfectant which has kept the air pure, and, to a great extent, free from poisonous matters for many thousands of years. And the probability of this opinion is greatly strengthened by the fact that ozone has the power of destroying organic colouring matters, arresting putrefaction, and removing disagreeable effluvia —properties closely allied to those of disinfectants.

The majority of competent authorities have, however, entirely abandoned the idea of the matters of contagion being gaseous, and now firmly believe it to be a finely-divided solid, which, like the pollen of flowers, or the volatile odorous principles of plants and animals, occurs in a state of such fine tenuity as to be undetectible by chemical or microscopical examination, and maintains its characteristic activity though carried for considerable distances through the air, or retained for a long time in clothes or other organised substances.[1] It is interesting to remark, as helping to explain the way in which disinfectants operate, that the matters of contagion, like all other organic products, must, as Dr George Wilson has suggested,[2] consist of "carbon, hydrogen, oxygen, and nitrogen, or at least of two (if not always of three) of these elements; and that like all such compounds, they are readily decomposed by chemical re-agents, especially oxidizing ones. There is no reason to imagine that infectious matters are difficult to decompose, *provided we can reach them.* The difficulty lies in reaching them. Assuming, then, that contagious matters are not volatile, and that they contain (to take the most complex case) carbon, hydrogen, oxygen, and nitrogen, the principles which are to guide us in the application of chemical disinfectants will not be far to seek. Oxidizing agents will plainly be of great value, as they can readily convert hydrogen

[1] Graham's Elements of Chemistry, p. 336.

[2] Pharmaceutical Journal, December 1852. "On some of the more important chemical disinfectants," by Dr George Wilson, Lecturer on Chemistry, Edinburgh.

into water, and carbon into carbonic acid, and thus disintegrate and destroy the morbific matter. Substances having a great affinity for hydrogen, such as chlorine and its class, will, plainly, also be of great service. Substances having an affinity for oxygen will also be applicable to the destruction of organic poisons. And finally, all re-agents, which by contact with organic matter, can determine a new arrangement of its ultimate elements. All the powerful chemical disinfectants act in one, or other, or all of those ways."

The most common disinfectants in use in veterinary practice, are chlorine, with its several compounds, as chlorides of lime and soda; nitric, nitrous, and hydrochloric acids; sulphurous acid, sulphite of soda, potash, soda, lime, and charcoal. The last two are mechanical rather than chemical in their action, and are chiefly useful in virtue of their absorbing the poison in the same manner as they do colouring and odorous matters. Chlorine and its compounds alter the composition of the contagious poison, and so deprive it of its injurious effects, probably by uniting with its hydrogen; while acids induce a similar effect either by oxidising or deoxidising. But besides these, ozone, the body above referred to, must now be added to our list of disinfectants, for it has already been found a powerful antiseptic and deodorizer; and, being devoid of irritating or injurious properties, could be freely used in a building without the removal of the inmates. Experiments, however, are still wanting to establish its exact disinfectant value, and as yet no convenient process has been found for its preparation. All these disinfectant bodies are very effectual both as antiseptics and deodorizers; indeed, their efficacy for the two latter purposes, affords one of the chief means of estimating their disinfectant value. In practice it is found best to use several disinfectants conjunctly. Chlorine, nitrous, or sulphurous acid, should be set free in large quantity within the building to be disinfected, and the walls at the same time washed with lime-water or alkaline ley. Air in abundance should be allowed free access, in order to dilute the miasmata and so deprive them of their morbid power. Cleanliness must also be strictly enjoined, as filth and litter are very apt to absorb the miasmata, and so become fomites, favouring the continuance and spread of the disease. Such measures should be especially adopted in the case of contagious disorders, as glanders and farcy in horses, and pleuro-pneumonia in cattle; but are also of utility in other diseases, particularly those of an epizootic character.

ANTIDOTES.

Antidotes (ἀντί, *anti*, against; and δίδωμι, *didōmi*, I give) mitigate or arrest the action of poisons. A poison, in the popular acceptation of the term, is a substance which, in inconsiderable amount, destroys health and life, but in reality it differs from a medicine only in the degree or intensity of its effects; indeed, it is found that, whilst many valuable medicines, when given injudiciously, or in large doses, become active poisons, many poisons, when properly administered, become valuable medicines. True chemical antidotes unite with the poison, forming either a mild, innocuous compound, or an insoluble one. Thus alkaline solutions are antidotes for poisoning with the mineral acids, on account of their forming with them mild laxative salts; albuminous matters for poisoning with corrosive sublimate, on account of their forming with it the harmless albuminate of mercury; and the mixed oxides of iron for poisoning with prussic acid, on account of their forming with it insoluble Prussian blue. Some antidotes counteract or relieve the symptoms produced by the poison; ammonia, for example, is useful in overcoming the sedative effects of poisoning by prussic acid; and opium in lessening the unpleasant consequences of irritants. In all cases of poisoning, it is of importance at once to evacuate the stomach in order to get rid of any poison still remaining there. This may be effected by the stomach pump, or more effectually in carnivorous animals by emetics. In the case of corrosive and irritant poisons, demulcents may be given to sheath and protect the mucous surface of the canal; but large quantities of fluid should not in general be given until the stomach is evacuated, as they are apt to facilitate the solution and absorption of the poison. After poisons have got access to the blood, the judicious administration of purgatives and diuretics is often effectual in expediting their excretion and promoting restoration to health.

CAUSTICS—ESCHAROTICS.

Caustics (καίω, *kaiō*, I burn ; καυστικός, *kaustikos*, burning) decompose both the solid and fluid animal tissues. They act in the first instance chemically, separating water from the tissues, and combining with their albumen fibrine and other organic constituents. This chemical action, which is true combustion, destroys the vitality of the part, and produces an increased vital action in the surrounding tissues. The caustics in common use in veterinary practice are salts of alumina, zinc, lead, copper, mercury, and arsenic, nitrate of silver, potash, and concentrated acids. These differ chiefly in the intensity of their action, some being so mild that they have no effect on the sound skin, and scarcely any on the mucous surfaces, and others so active as to cause extensive sloughing and purulent discharge. Those possessing the latter action sometimes receive the special title of escharotics (ἐσχάρα, *eschara*, an eschar, scar, or scab). The difference between solid and fluid caustics is not great. The effects of the latter are more rapid and powerful, but more difficult to localise than those of the former. The firing iron or actual cautery, when used at any temperature above a full red heat, acts in exactly the same manner as caustics, producing first a chemical action, and then a highly exalted vital action. Besides being used as a caustic, it is also much employed as a counter-irritant (p. 23).

Caustics are used for many different purposes—for repressing soft, spongy, and exuberant granulations; for removing warts and other sorts of tumours, especially when so deep-seated and vascular that they cannot be safely extirpated by the knife ; for altering morbid actions of the skin or of wounds ; for exciting adhesive action in the walls of fistulæ ; for preventing the effects of poisoned wounds, in which case fluid caustics are often preferable to solid ones, on account of their readily penetrating to all parts of the cavity; for opening abscesses and forming issues; for expediting and completing the destruction of sloughing textures; and for arresting hæmorrhage from accidental or surgical wounds. Caustics employed for the last mentioned purpose usually receive the special title of *styptics* (στύφω, *stüphō*, I constringe; στυπτικός, *stüptikos*, astringent). In using them, the blood should be removed by a sponge, and the part lightly pressed, so that the blood-vessels may be more readily seen, and the caustic applied to them with greater precision.

ACIDS.

Acids (ἀκίς, *akis*, a point) are defined by the chemist as substances which are sour to the taste, redden vegetable blues, and unite with bases to form salts. Those commonly used in veterinary practice are the three mineral acids, sulphuric, nitric, and hydrochloric, with acetic acid. In large doses and concentrated form they act as chemical corrosives, decomposing the tissues by uniting with their watery, albuminous, and saline parts. They are, therefore, all included under the head of caustics. They are useful antidotes in poisoning by alkalies. When given internally they usually become absorbed without previous neutralisation. The changes which they undergo after entering the blood are quite unknown, and whether their action be chemical or vital is still matter of speculation. It is observed, however, that they usually exert a tonic action, improving the appetite and the general strength; and as they are sometimes excreted from the body imperfectly neutralised they counteract alkalinity, especially of the urine, and also act as astringents. Besides these effects, they are also, along with acid salts, said to act as refrigerants, or, in other words, to reduce the animal heat and lower the pulse. This, however, is not sufficiently established. Indeed, a practical physician, and high therapeutic authority, remarks:— "We have often endeavoured to observe whether they ever do produce any real diminution of the animal heat, and whether, therefore, their title, refrigerant, is really merited. We have not been able to satisfy ourselves of this; but we know, both from active and passive experience, that they give for the moment a *sense* of coolness which renders them truly delicious, either under a fever or a hot sun."[1] The so-called refrigerant effect which acids and various other substances are thought to produce when given internally, consists, therefore, in the gratefully cooling, though very temporary, impression which they make on the nerves of the throat and stomach; whilst the obvious good which often follows their exhibition depends on some of their known physiological effects. Acids will again be noticed under the heads of tonics and astringents.

ANTACIDS—ALKALIES.

Antacids (ἀντί, *anti*, against; and ἀκίς, *akis*, a point) include the alkalies, potash, soda, and ammonia; the alkaline earths, lime and magnesia; the carbonates and bicarbonates of these bases, and the neutral salts which they form with vegetable acids, which last are converted into carbonic acid in their passage through the body. Antacids, and especially the most active of them, as the alkalies, are in large quantity corrosive, dissolving albuminous matter, and saponifying fat. They are prescribed as antidotes against acids of all kinds, and wherever occurring. Thus, they are administered for the purpose of neutralising either mineral or vegetable acids, which may have been given as poisons; and for removing acidity of the alimentary secretions, with the indigestion and diarrhœa to which such acidity often gives rise. When not required in the system, they are excreted in the urine, increasing its alkalinity, and counteracting any tendency to lithic acid deposits, which, however, are exceedingly rare either in horses or cattle. But while these medicines remain in the system, they often appear serviceable, especially during inflammatory, febrile, and rheumatic affections. In these cases, they probably assist in maintaining the normal amount and solubility of the fibrine; indeed, out of the body they certainly

[1] Monthly Journal of Medical Science, March 1853, p. 259.

have the latter power on fibrine. Their *modus operandi*, however, is not very obvious, nor is this difficulty overcome by considering them as *alteratives*, as many do; for that term, in its true and original meaning, is equally applicable to all medicines, for all alter the properties or functions of the parts on which they act. Yet the term alterative, thus meaningless though it be, is often applied both to alkalies and other medicines, as if it really afforded a satisfactory explanation of their action and mode of curing disease.

RUBEFACIENTS—VESICANTS—SUPPURANTS.

These three varieties of irritants agree in so far as they induce inflammation of the skin, but differ considerably in the degree and intensity of their action. *Rubefacients* (*ruber*, red; and *facio*, I make) include substances which slightly inflame and redden the surface of the skin, as alcohol, linimentum ammoniæ, mustard, and mild preparations of cantharides. Smart friction and moderate heat must also be included in this class. In the lower animals, however, the colour of the skin and the abundance of the hair renders the reddening action of these agents considerably less obvious than in man. *Vesicants* (*vesica*, a bladder) have a more active and deep-seated effect, causing inflammation of the true skin, with effusion of serum between it and the cuticle. The serous effusion filling these vesicles or blisters consists, according to M. Magueron (quoted by Dr A. T. Thomson), of about seventy-eight parts of water, eighteen of albumen, and four of salts. The quantity and rapidity of the effusion vary much according to the substance used, but are especially great in the case of steam and boiling water. After some days, the blisters either dry up, or, when the inflammation has been considerable, secrete a muco-purulent fluid, which hardens over the parts, protecting them until the new skin appears. Cantharides, turpentine, ammonia, and boiling water, are the vesicants in most common use in veterinary practice. *Suppurants* (*sub*, under; and *pus*, pus) are still more powerful than either rubefacients or vesicants, and actively inflame the deep-seated tissues of the skin, causing a crop of pustules and a purulent discharge. This is the effect of croton oil and tartar emetic, and also of cantharides, mustard, and other active vesicants, when applied to the same spot repeatedly or in large quantity.

Most of these agents act with tolerable certainty on the skin both of horses and dogs, but very imperfectly on the thick and insensible hides of cattle. On these, alcohol, turpentine, and even cantharides, have but slight effect; and for them the only counter-irritants which are convenient, prompt, and effective, are mustard made up with equal parts of turpentine and ammonia, and scalding hot water, which latter is certainly the simplest, cheapest, and probably the best blister that can be used. In the case of dogs, blisters require to be cautiously applied, as the skin is often so irritable and sensitive that the animals bite and rub the blistered parts, and thus induce sloughing. There is a curious and inexplicable anomaly in regard to the action of turpentine on the skin of the horse. If applied over a considerable surface, it produces such intense itching irritation, that the animal sometimes becomes for a short time quite frantic and unmanageable, which is the more remarkable, as turpentine has scarcely any irritant effect on the skin of man, which is so highly susceptible of the action of other irritants. *Setons* are sometimes substituted for blisters, but are not so serviceable, except in cases where long continued counter-irritation is to be maintained. They act chiefly on the comparatively insensible sub-cutaneous cellular tissue, and are, consequently, neither very rapid nor very powerful in their effects. The hot iron or actual cautery is also much used in veterinary practice as a counter-irritant. It is generally applied at a full red heat, and the higher the temperature, the less the pain attending its application. Besides being applicable to the same uses as active vesicants, it is employed for many of the purposes of caustics; and when used at a sufficiently elevated temperature, resembles these in abstracting water from the tissues, and in inducing, in the first instance, an active chemical effect. Its beneficial application in cases of diseased joints, ligaments and tendons, in which it is so often used, depends on its exciting a superficial inflammation, and not as was once currently believed, on its forming a permanent bandage around the parts. Indeed, though the skin for a short time after the operation, is corrugated and tightened, it soon resumes its natural elasticity, and does not embrace the subjacent parts more firmly than in health. It is a prevalent idea that the efficacy of these counter-irritants may be measured by the amount of the discharge which they induce. But this is by no means a general rule, for the amount of the counter-irritation and of the discharge do not bear a constant relation to each other; and the only accurate method of judging of the power or value of any counter-irritant, is by the intensity and continuance of the inflammation which it excites.

The uses of rubefacients, vesicants, and suppurants, are very analogous. They are applied as topical stimulants to indolent sores and ulcers, and occasionally to inveterate cases of mange, scab, and other scaly skin affections. The substances mentioned as vesicants are best adapted for these purposes. They are all of them in common use for producing counter-irritation or derivation in inflammation of the joints and surrounding tissues, and of the eye, lungs, and intestines, with their investing membranes. Thus used they excite externally a simple and manageable inflammation, which takes to itself a large amount of blood and nervous influence, and so starves out and removes the more serious and deep-seated inflammation. Counter-irritants, though very serviceable in subacute or chronic inflammation, are useless, and often injurious in acute inflammation, especially if it be accompanied by much constitutional fever. In the latter case they either have no effect at all, or only aggravate the inflammation which they are intended to cure. Counter-irritants should be applied as near the seat of the disease as possible, but not directly to tissues of the same kind as those inflamed, or immediately continuous with them. Before the application, the skin should be well washed with soap and water, and the hair, when long or thick, removed with a pair of scissors or a razor. The effect of the application may also be further expedited and increased by subjecting the part to smart friction, or the action of boiling water, and by rubbing the agent well in, taking care to spread it over an amount of surface at least as great as that diseased.

ERRHINES.

Errhines (ἐν, *en*, in; and ῥίν, *rhin*, the nose) are a small and unimportant class of topical irritants, which act on the nasal mucous membrane, causing discharge of nasal mucus and sometimes sneezing. This latter consists in a forcible expulsion of air through the nostrils, and is a reflex action excited for the purpose of removing any irritant lodged about the nasal passages. Almost all irritant and acrid substances, when directly applied to the Schneiderian mucous membrane, act as errhines, but those chiefly used are muriate of ammonia, subsulphate and iodide of mercury, tobacco, euphorbium, veratrum album, and its alkaloid veratria. Errhines, although now disused, were formerly prescribed to cause counter-irritation, in affections of the eyes and head, and to expel, by inducing sneezing, foreign substances lodged in the nostrils, nasal sinuses, or respiratory passages.

STOMACHICS—CARMINATIVES.

Stomachics (στόμαχος, *stomachos*, the stomach) are substances which promote digestion. They include most spices and condiments, as ginger, carraway, and anise, with various other seeds from the natural family *umbelliferæ*, and several volatile oils, as peppermint and rosemary, from the *labiatæ*. On account of their gently stimulating the stomach, they are given to relieve simple indigestion, and to remove flatulence and slight colic pains, in which case they usually receive the special title of *carminatives*. They are also used to expedite and facilitate the action of purgatives, and to impart an agreeable flavour to many sorts of medicines.

EMETICS.

Emetics (ἐμέω, *emeō*, I vomit; ἐμετικός, *emetikos*, a vomit) induce an antiperistaltic motion of the œsophagus and stomach, and, in severe cases, of the anterior portions of the small intestines, with increased secretion from all these parts. They have no obvious effect on horses; indeed, vomiting only occurs in these animals from rupture of the stomach or intestines, or from the effects of aconite and a few other poisons. This appears to be occasioned by the smallness of the stomach, the acute angle at which the œsophagus enters it, and the impossibility of its being compressed between the diaphragm and the abdominal muscles. The position and length of the velum palati, even supposing the contents of the stomach to get so far in their upward progress, would cause them to pass out by the nostrils and not by the mouth, as in true vomiting. It might reasonably be presumed that as cattle naturally ruminate, they might also readily perform the analogous act of vomiting; but none of the substances which cause vomiting in other animals have any such effect on cattle. This is probably due to their large, subdivided, and comparatively insensible stomach. The dog and pig, however, can be made to vomit very easily and speedily; indeed the former often purposely brings on vomition, by eating the *triticum repens* and other emetic grasses, which his instinct readily enables him to discover. In the dog, the act is so natural and so readily induced, as to be capable of being caused by almost all disagreeably tasted, nauseous, or acrid substances. The emetics in common use are—mustard, tobacco, ipecacuanha, common salt, sulphates of zinc and copper, tartarised antimony, and tepid solutions of many salts. These emetics differ somewhat from each other in their effects. Sulphates of zinc and copper act with great rapidity, whilst tartarised antimony and tobacco are somewhat more tardy in their action. The former two cause a greatly increased mucous secretion, but have not such a marked sedative effect as the latter. Some emetics, as mustard and most metallic salts, act chiefly in virtue of the local irritation which they produce, and have consequently little effect, unless placed in contact with the mucous membrane of the stomach. Others, however, as tartar emetic, ipecacuanha, and tobacco, appear to owe their effects chiefly to their being absorbed and operating on the nervous centres connected with the stomach. These, consequently, act with nearly equal certainty by whatever channel they enter the body. When an emetic has been given, it first causes nausea, and then, in from two minutes to half an hour, vomiting, which continues for a variable length of time. In the meanwhile, the animal heat is raised, the pulse somewhat quickened, the respiration disturbed, and, when the straining is excessive, fæces and urine are sometimes passed involuntarily. The matter vomited usually consists of a portion of the emetic and the contents of the stomach, together with mucus, which is secreted in large quantities, and occasionally a small amount of blood, which generally comes from the pharynx. After the vomiting has entirely ceased, the pulse and respiration fall below their natural standard, and hence the value which emetics possess as sedatives. Where the action has been violent or long continued, it is usually succeeded by considerable prostration of strength. The act of vomiting is a good illustration of what is termed a reflex spinal action. In the majority of cases, where for example a dose of common salt is swallowed, the impression which the medicine makes on the mucous membrane of the stomach, is conveyed by the appropriate nerves (the pneumogastric and occasionally the splanchnic) to the medulla oblongata, whence the influence which produces the several motions, together constituting the act of vomiting, arises, and is distributed by the motor nerves. Tartarised antimony and other emetics which operate by whatever channel they enter the blood, probably either act directly on the medulla oblongata and other nervous centres, which preside over the movements of the stomach; or, according to Mr Headland, owe their effects to the derangement which they produce in the functions of the vagus nerve. Dr Marshall Hall has shown that the several motions constituting vomition occur as follows:—The larynx is closed, the cardiac orifice of the stomach is opened, all the muscles of expiration are called into action, the diaphragm alone remaining a fixed surface against which the stomach is pressed; and finally, as expiration is prevented by the closure of the larynx, the whole force of the effort is concentrated in emptying the stomach.

Emetics are chiefly used for evacuating the stomach, in order to expel crude undigested food, poisons, or other foreign bodies; for clearing away obstructions from the throat or œsophagus; and for depressing the circulatory and nervous systems. In virtue of this sedative effect, they are serviceable in canine practice for the arrestment of distemper and other febrile attacks, and for the antiphlogistic treatment of all sorts of internal inflammation, except that of the alimentary canal. They were formerly sometimes used to cause relaxation of muscular fibre and reduction of dislocations, but for these purposes chloroform has now entirely superseded all other remedies.

ECBOLICS—PARTURIENTS.

Ecbolics (ἐκ, *ek*, out of; and βάλλω, *ballō*, I throw) are medicines which are believed to cause contractions of the uterus, and expulsion of its contents. They are represented by such substances as ergot of rye, savin, rue, cantharides, and gamboge. They have, however, in reality no special action on the uterus, but owe their effects to their violently exciting neighbouring parts, as the intestines or kidneys. They cannot produce abortion or hasten the period of parturition, without causing such constitutional irritation as to render their employment dangerous to life. Some of them, especially ergot of rye, are occasionally given during the act of parturition, to increase the uterine contractions, and expedite the expulsion of the fœtus. Even in such cases their utility has been greatly over-estimated. Indeed, veterinarians have little occasion for the use of such agents, since, with a little time and patience, parturition in the lower animals is usually effected easily and safely, and without much interference or assistance.

APHRODISIACS.

Aphrodisiacs (ἀφροδίσια, *aphrodisia*, venery) are substances which have, or are supposed to have, the power of exciting the venereal appetites. They include such articles as phosphorus, cantharides, peppers, and turpentines. On the Continent they still appear to be frequently given to various of the domesticated animals, especially to cattle; but their employment is unnatural and unscientific, and further fails to produce the desired effect. When the powers of procreation are defective, instead of employing any of these drugs, the cause occasioning the loss of power should be sought for and removed. If it consist, as it often does, in general debility, the appropriate treatment will consist in a generous diet and tonic medicine.

CATHARTICS—PURGATIVES.

Cathartics (καθαίρω, *kathairō*, I cleanse or purge) augment the intestinal secretions, and quicken or increase the evacuation of fæces. Some of them, like errhines or vesicants, produce topical irritation of the alimentary mucous membrane, succeeded by increased secretion and peristaltic motion. The husks of grain, vegetable fibres, and other indigestible substances, probably act in this way, as also many resinous and comparatively insoluble cathartics previous to their absorption. All active cathartics, however, become absorbed. When given in the usual way by the mouth, they are first taken up by the capillary veins of the stomach and small intestines, and thence enter the general circulation. Being unfit for remaining in the blood or becoming assimilated, they are speedily returned to the intestinal mucous membrane, where they are separated from the blood by innumerable active secretory glands, and poured into the intestinal tube along with the increased secretion to which they give rise. During both their absorption and excretion, they cause irritation of the mucous membrane, and consequently increase the peristaltic motions, which, when excessive, occasion the pain and spasms accompanying the action of violent purgatives. Different cathartics appear to be excreted from different parts of the alimentary canal. Jalap is believed to be chiefly separated from the surface of the small intestines; aloes from the large intestines; and croton and saline purgatives from both. Excretion, however, from *some* part of the alimentary mucous membrane appears to be essential to the full effect of all active purgatives; for aloes, salts, and the like lose their purgative effect when administered in combination with articles which prevent their excretion, or cause them to be removed by the kidneys or other emunctories. In corroboration of this, Dr Ward records the interesting case of a woman in whom castor-oil did not produce purgation, but was exuded from the skin, and acted as a diaphoretic.[1]

Cathartics vary much in the intensity of their action. When mild they are termed *laxatives;* when they induce copious watery discharges, *hydragogue* cathartics. Given injudiciously, or in excessive doses, cathartics sometimes induce fatal superpurgation, and sometimes enteritis; and these untoward effects are especially apt to ensue in irritation or inflammation of the skin or mucous membrane of the air-passages, particularly in the horse. And the reason of this is obvious, for such irritation or inflammation is very apt to extend to the intestinal mucous membrane, on account of the direct continuity and structural resemblance which exists between all these parts. I have seen a horse affected by bronchitis die from superpurgation, induced by only three drachms of aloes, and an almost equal degree of susceptibility to the action of very moderate doses is also observable in erysipelas, scarlatina, purpura hæmorrhagica, and laminitis.

The intestines of man have a superficial extent of about 1400 square inches (Meckel). Those of the horse being three times the length, and having at least three times the calibre of the human intestines, must consequently have a surface of about ninety square feet. The whole extent of this surface is covered by a highly vascular mucous membrane, packed full of actively secreting glands, and abundantly supplied with nervous influence. Such an immense extent of intestinal mucous membrane in such a vascular and sensitive state, necessitates great caution in the administration of purgatives to the horse. If possible, the animal should be restricted for at least a day previous to the exhibition

[1] Essay on the Actions of Medicines, by F. W. Headland, p. 261.

of the dose, to mash diet or green food. The dose should be small, as its effect may be accelerated and increased by administering it while the animal is fasting, by occasional exercise, until it begins to operate, and by the repeated use of clysters. This last auxiliary, when employed with sufficient perseverance, is indeed so effectual in promoting the action of the bowels that one most successful army surgeon with whom I am acquainted, trusts almost entirely to its use, seldom giving, except in extraordinary cases, any purgative medicine whatever. For horses, aloes is probably the best of all cathartics. The fixed oils are tolerably good, but less certain ; while croton is much too drastic, unless in small amount and largely mixed with other less potent medicines. Saline cathartics are irregular, and sometimes act with unexpected violence. Senna, colocynth, buckthorn, and various other substances of much value as purgatives for men and dogs, have scarcely any such effect on horses. Purgation may be produced in the horse in from eighteen to twenty-four hours, and sometimes in a shorter period, if the auxiliary treatment above mentioned be adopted, as it invariably should be.

In cattle and sheep, the magnitude of the *quadrisected* stomach, the large proportion of food which it always contains, and the comparatively low vascularity and sensibility of the whole alimentary canal, render the action of many purgatives far less certain than in most other animals. For these ruminants saline purgatives are preferable to any others, and their action may always be materially expedited by encouraging the animals to drink water, which may be rendered more palatable by sweetening it with treacle. In obstinate constipation, or torpidity of the bowels, croton and calomel are often useful. In ordinary circumstances purgation may be produced among cattle in from twelve to sixteen hours, but cases frequently occur where, in spite of all treatment, the bowels remain unmoved for several days.

On account of the small size of his stomach and alimentary tube, and the less bulky nature of his food, the dog is peculiarly susceptible to the action of purgatives. In him they generally operate in from five to eight hours. Jalap, with a little calomel or castor oil, are those most generally approved of. Aloes acts more slowly and uncertainly, while saline medicines are too apt to cause vomiting. Indeed, all purgatives must be given to dogs in a well-prepared condition; for, when unpalatable, acrid, nauseous, or bulky, they are very apt to be expelled by vomiting. The action of cathartics on the pig is closely analogous to its effects on the human subject and dog.

No class of medicines is applied to so many important purposes as cathartics. They are the most certain and effective evacuants, and sometimes little inferior to blood-letting.

1st. Cathartics are given to remove from the alimentary canal undigested food, feculent matters, poisonous substances, and worms. When employed for the destruction or expulsion of worms, they generally receive the special title of *anthelmintics* or *vermifuges*, and often owe their success simply to their causing such increased peristaltic motion and excessive secretion of fluid, as to unlose the hold which the parasites have on the intestinal walls, and wash them entirely away. Some anthelmintics, however, destroy the worms by poisoning them. Such are turpentine, various pungent volatile oils, ethers and bitter substances, as jalap, gentian, and pomegranate root bark (the male shield fern ?). When a vermifuge is required it is generally advisable to combine some of these agents with an ordinary purgative, to give the mixture while the animal is fasting, and to use clysters of soap and water, with a little turpentine, especially if there be reason to suppose that the worms are lodged in the rectum.

2d. Cathartics are exhibited in order to diminish the watery parts of the blood. This they effect very rapidly, owing to the large extent of actively secreting intestinal surface on which they act. From thus directing large quantities of blood to the intestinal mucous membrane, from robbing it of a great amount of its fluid parts, and also from determining to the same surfaces a large amount of nervous influence, purgatives are of much service in starving out and subduing inflammation of all internal parts, except the intestines themselves. When thus employed they act on the principle of counter-irritation or derivation. In many cases of inflammation, accompanied by high fever, it is difficult, however, to establish purgation, on account of the fulness of the vascular system; and in such cases much advantage results from combining the purgative with some sedative, as tartar emetic, calomel, or aconite. Purgatives are often effectual in causing the absorption of dropsical effusions, for when the proportion of its watery parts is diminished, the blood endeavours to regain its normal density by absorbing fluid from whatever source it can be procured.

3d. Cathartics are given to increase the activity of the intestinal mucous surfaces, and thus accelerate the separation from the blood of effete matters produced by the disintegration of the tissues; of morbific matters which may have found their way into the blood, or been engendered there; and of excrementitious materials, the accumulation of which may have been induced by arrestment of the functions of the skin or kidneys. Nature herself sometimes adopts this method of removing deleterious matters from the blood, by the establishment of spontaneous diarrhœa. This depurative action, whether induced naturally or artificially, is of great service in removing febrile attacks, relieving nervous diseases, and accelerating the cure of most inflammatory disorders.

4th. Most active cathartics are believed to cause an increased secretion of bile, and are hence termed *cholagogues*. The only undoubted examples of this action are calomel and other mercurials, but some further add aloes and rhubarb. Cholagogues are prescribed in jaundice and other cases, where torpidity of the liver is suspected.

EXPECTORANTS.

Expectorants (*ex*, out of; and *pectus*, the breast) are substances which increase the natural secretions of the mucous membrane lining the trachea, bronchi, and other parts of the respiratory apparatus. Some of them exercise merely a topical effect, as chlorine, iodine, ether, tobacco smoke, and the vapour of water; whilst others, as ipecacuanha, balsams, gum-resins, and probably antimonials, become absorbed, and entering the circulation, exercise a special stimulant effect on the mucous glands of the respiratory mucous membrane, through which they are excreted. Expectorants are very uncertain in their action, even on man, and still more so on the lower animals, in which we have no evidence whatever of expectoration. They are now never used in veterinary practice.

DIAPHORETICS—SUDORIFICS.

Diaphoretics (διαφορέω, *diaphoreō*, I throw off by perspiration), and Sudorifics (*sudor*, sweat; and *facio*, I make) are similar in their nature, actions, and uses. Strictly speaking, the former increase the insensible, and the latter the sensible, perspiration. This is, however, a difference only in degree of action.

In all the higher animals, the skin performs several very important functions. Besides protecting the sensitive parts alike from cold and external injury, and being intimately connected by vessels and nerves with all parts of the body, it also acts as a pneumatic apparatus, excreting carbonic acid from the system, and probably also absorbing oxygen. The excretion of carbonic acid is of such essential importance to life and health, that asphyxia soon occurs in any of the higher animals when the functions of the skin are arrested by covering it over with a thin varnish. The skin is further the channel through which the system ejects a very large, though variable, amount of refuse fluid matters, holding in solution various salts and effete organic matters. These latter are in much greater amount than is generally believed. In man, it is estimated that 100 grains of azotised matter are excreted daily from the skin (Carpenter); and in horses and cattle the quantity must be at least three or four times greater. During those diseases in which the functions of the kidneys, lungs, or bowels are disturbed or arrested, this depurative action of the skin is of the greatest possible service in preventing the blood from being poisoned by the accumulation of deleterious matters. In such cases, the skin takes on a vicarious action, and excretes those effete matters which are usually disposed of by other channels. Such considerations as these indicate the paramount importance of always preserving the skin in a clean and healthy state. In all animals, cutaneous transpiration is the result of two actions—first, a physical process of evaporation, depending on the porosity of the tissues, and occurring alike in animate and inanimate objects; and secondly, a vital process of transudation or secretion, analogous to that occurring in other parts of the body, and capable of being modified by external agencies. Diaphoretics accelerate the latter of these processes, either by exciting the general circulation, as is the case with active exercise; or more commonly by stimulating the cutaneous glands and vessels, as is the case with friction, warm clothing, and certain medicines.

In the lower animals, diaphoretics are less prompt and certain than in man, and this chiefly depends on the skin of quadrupeds being thicker and more plentifully covered with hair or wool, and on the fact that most medicines of this class are especially apt to pass off by the kidneys or bowels, rather than by the skin. Perhaps the best and simplest method of causing diaphoresis in veterinary patients, is to administer diluents in large quantity, to apply smart friction over the surface of the body, and subsequently to keep the animal in a dry warm atmosphere, and well covered with horse-cloths. In conjunction with this treatment, small and repeated doses of some of the following medicines should also be given:—acetate of ammonia, sweet spirits of nitre, sulphuric ether, ipecacuan, volatile oils, Dover's powder, and antimonials. These diaphoretic medicines, like other evacuants, become absorbed. Being foreign elements, however, they do not remain long in the blood, but are speedily attracted towards the skin, and produce there a stimulant effect, and an increased secretion, by which they are carried out of the body.

In connection with this subject, it may be remarked that warm and vapour baths have been used successfully in veterinary practice, and, like diaphoretics, prove beneficial chiefly by augmenting the healthy functions of the skin. The hydropathic method of sweating a patient has also been sometimes usefully employed in regular practice. The patient is enveloped in a sheet saturated with cold water. Over this are placed three or four or half a dozen large horse-cloths. The legs should be subjected to similar treatment, or rolled in warm bandages. After the patient has been thus clothed for half an hour or an hour, he will steam and perspire very freely. After from one to three hours, according to circumstances, the sheet and rugs should be removed, and the animal dried by hand-rubbing, and comfortably clothed. This mode of practice has been tried both with horses and cattle, and seems useful in many cases of rheumatism, and especially in gross subjects. It should not, however, be adopted unless with due consideration, and under competent superintendence.

According to Pereira, diaphoretics are used for the following purposes :—

1st. To restore the cutaneous secretion when it has been arrested, in order to prevent the evil consequences of its suppression, as in catarrh, colds, and rheumatism.

2d. To cause the excretion through the skin of morbid matters, in order to remove or alleviate such diseases as naturally terminate by excessive cutaneous secretion, as exanthemata and intermittents.

3d. To cause determination of blood and nervous influence to the skin, in order to relieve internal congestions and inflammations.

4th. To antagonise other secretions—to check, for example, excessive diuresis or diarrhœa.

5th. To establish a substitute for some other secretions, as in dropsy, and in cases where the urinary discharge is diminished or arrested.

DIURETICS.

Diuretics (διά, *dia*, through ; οὐρέω, *oureō*, I make water) are remedies which increase the secretion of urine. This may be effected by giving either large quantities of fluid or certain saline, resinous, or other soluble substances which have a tendency to pass out of the system in the urine. All diuretics, of whatever description they be, enter the blood; but not being required there, are speedily directed towards the kidneys as the organs best adapted for their excretion. As is always the case with organs acted on by evacuants, these glands become excited to increased activity, and hence a copious flow of urine, in which the irritant substance—the cause of the action—is carried away. Although diuretics greatly augment the watery parts of the urine, they do not increase, but, on the contrary, usually diminish, the proportion of salts and organic matters expelled in it in a given time. Mr Bowman's view of the action of diuretics appears to afford a very satisfactory explanation of this. He supposes that all such medicines stimulate the Malpighian bodies, which are intended for the secretion of the watery parts of the urine, but have no such effect on the uriniferous tubes or their capillary plexuses—the apparatus concerned in the secretion of the characteristic solids of the urine. It may be that diuretics cause so much congestion of this uriniferous apparatus as to arrest its functions; indeed, when the doses are too large, similar congestion and arrested function appear to extend to the Malpighian bodies, completely suspending the secretion of urine.

The diuretics commonly used in veterinary practice are alkalies, with alkaline and neutral salts; turpentine with most resins and many volatile oils; sweet spirit of nitre and most etherous and alcoholic fluids; digitalis and cantharides. When used as diuretics, neutral salts must be given in moderate quantity, for in large doses they act chiefly on the bowels. Diuretics usually act certainly and speedily on all classes of veterinary patients. Their actions are best ensured by giving small and repeated doses, by using several together, and by encouraging the animal to drink large quantities of water or some other fluid—in short, by promoting as much as possible the excretion of the medicine by the kidneys, rather than by the skin or bowels.

In the treatment of disease, diuretics are used chiefly for the following important purposes:—1st. To restore the healthy action of the kidneys in diseases in which the secretion of urine is diminished. 2d. To promote the absorption of dropsical effusions by removing water from the blood, which, in order to recover its normal density, absorbs the anasarcous or dropsical swelling. 3d. To promote the elimination of poisonous agents from the blood—a purpose for which diuretics have been strongly recommended by Orfila and other toxicologists, who find that, in the case of arsenic and several other drugs, doses adequate to occasion poisoning may be given with impunity, provided active diuresis be speedily induced. 4th. To augment the proportion of water in the urine, and so to prevent the deposition of its solid parts in the bladder or other urinary passages. For this purpose, diuretics are frequently used in the human subject, occasionally in dogs, but very seldom either in horses or cattle, as these are little subject to gravel. 5th. To assist in removing inflammation by exciting counter-irritation; by diminishing the fluid parts of the blood; and also, in a more advanced stage, by carrying away the deleterious matters produced by the inflammation or accumulated in the system on account of the general arrestment of secretion.

SIALOGOGUES.

Sialogogues (σίαλον, *sialon*, saliva; and ἀγωγός, *agōgos*, evoking) increase the salivary and buccal secretions. They act in one of two ways, either producing a local irritant effect, or undergoing absorption and exercising a special action on the salivary glands and mucous follicles. Ginger, mustard, tobacco, and radish act in the former, and mercury, and to a certain extent salts of gold and antimony, iodine, and almost all nauseants, in the latter of these two ways. In works on the materia medica published so lately as 1810, the list of sialogogues sometimes included upwards of a hundred substances; but in the present day remedies of this class are only used empirically.

TONICS.

Tonics (τόνος, *tonos*, tone) are agents which increase the general tone and vigour of the system. They are defined by Dr Billing as "substances which neither immediately nor sensibly call forth actions like stimulants, nor depress them like sedatives, but give power to the nervous system to generate or secrete the nervous influence by which the whole frame is strengthened."[1] Their modus operandi is not very evident. They certainly, however, become absorbed, and many of them may be detected in the blood and in various of the secretions. The different preparations of iron possibly owe their virtue as tonics, in part at least, to their providing iron for the hematosin of the blood-globules; and cod-liver oil and other oleaginous tonics to their supplying the fatty materials necessary for the manufacture of healthy blood. The larger proportion of tonics, however, are supposed to act, through the nervous system, on the contractile involuntary muscular fibres of the alimentary canal and circulatory system, thus inducing a more healthy state, both of primary and secondary nutrition. All tonics, in whatever manner they act, produce these obvious effects. They increase the appetite, the fulness and firmness of the pulse, the activity of all the bodily functions, the muscular power, and the capacity for endurance. These effects, though somewhat slowly developed, are usually very well marked, especially when tonics are given in cases where the appetite is deficient or capricious, the pulse weak and compressible, and the muscular system soft and flabby. When given to healthy animals in large and repeated doses, they do not, however, improve health; but, on the contrary, sometimes cause disorder of the digestive organs, and occasionally (in man and the dog) febrile symptoms. Similar effects sometimes also ensue from the injudicious administration of tonics to sick animals. Tonics, though bearing considerable resemblance to calefacients or general stimulants, are distinguished from them by the following well-marked characters. Their action is slowly and gradually induced, but tolerably permanent, and not succeeded by any subsequent depression; whilst the action of stimulants is speedily, and indeed almost immediately, developed, but proves very temporary, and is succeeded by a state of depression varying in proportion with the previous exci-

[1] First Principles of Medicine. 4th ed., p. 92.

tation. In short, tonics give strength, whilst stimulants merely call forth strength previously latent. Tonics also closely resemble astringents, but differ from them in acting more slowly, and possessing no obvious chemical influence, and no effect on animals except when alive.

Tonics are prescribed in indigestion and mal-assimilation when these depend on debility; in most diseases of a chronic and sub-acute character, when unaccompanied by acute fever; in scrofulous and other exhausting complaints; and during recovery from most debilitating diseases. In the human subject they have also a remarkable power of arresting agues and other periodic diseases, and that sometimes before many doses of the drug have been given, and before the development of any obvious physiological effect. Tonics should be withheld wherever there is active inflammation or acute fever; and they seldom do much good unless the bowels be in a tolerably regular and normal state. To ensure their full effect, they should be given at short intervals for a considerable period. In veterinary practice a good many mineral tonics, as salts of iron, zinc, and copper are employed; and also a few vegetable tonics, as gentian, quassia, rhubarb, and cinchona. Mineral tonics are generally the more active, and are hence better adapted for horses and cattle than vegetable tonics. The latter usually contain an alkaloidal or neutral principle of remarkable bitterness. They are mild, and hence well suited for early convalescence, and for cases where more active medicines might be too stimulating. They are often also useful for dogs. Cod-liver oil is the only tonic of animal origin prescribed in veterinary practice. Its use, however, is very limited, being entirely confined to canine practice. In addition to these medicinal tonics, we must not omit to mention the natural tonic—cold, a most valuable and convenient agent for relieving laxness and irritability dependent on weakness, and one which possesses the singular advantages over other tonics of being suitable for local as well as general purposes, and being applicable in many different ways.

CALEFACIENTS—GENERAL STIMULANTS.

Calefacients (*caleo,* I am warm; and *facio,* I make) are remedies which increase the animal heat. They are sometimes simply called stimulants, as they exalt the animal functions, especially those of the circulation. I have, however, preferred the term calefacients to that of stimulants, as the latter is too general in its signification, and in fact applicable to any class of remedies which exalt action. Calefacients include balsams, gum-resins, volatile oils, ammonia, alcohol, and ethers. They all become absorbed, and may often be detected in the blood, and in various of the secretions and excretions. They usually stimulate the organs by which they are evacuated from the system, and on this account frequently possess various subordinate actions, some being diaphoretic, others diuretic. Although acting probably through the nervous system, calefacients produce their most prominent effects on the circulation, causing increased fulness and frequency of the pulse, accelerated respiration, and augmented temperature of all parts of the body. In properly regulated doses they do not, however, affect the functions of the brain. Those which act with rapidity are termed *diffusible stimulants.* Such are ammonia, alcohol, and ethers. Their effects are, however, evanescent, and can be maintained only by frequently repeated doses. In the treatment of disease, calefacients are used to effect many useful purposes. Rousing the vital powers and increasing especially the action of the heart and the animal heat, they are valuable remedies in influenza, typhoid fever, and exhaustion. Equalising the balance of the circulation where it has been disturbed, and thus relieving excessive determination of blood to any particular part, they prove very effectual in removing congestion of the lungs, caused by violent and continued over-exertion, and in controlling those shivering attacks which are so often the precursors of internal disease, and which depend upon the blood leaving the skin and collecting in undue quantity round the internal organs. When used for these purposes they are sometimes known under the special title of *cordials.* The general action of calefacients is often accompanied by special local effects; thus they frequently improve the appetite and promote digestion, or, in other words, act as *stomachics;* they prevent or remove flatus, or act as *carminatives;* or they counteract spasm, in which case they are termed *anti-spasmodics.* Alcoholic and etherous substances, volatile oils, and all other diffusible stimuli, are anti-spasmodic. This, like most other curative or therapeutic effects, depends on a physiological action. The diffusible stimulant, in virtue of its own characteristic and inherent power, exalts nervous force, and thus overcomes that perverted condition of the nervous centres on which spasm invariably depends. From increasing the action of the heart and the general excitability of the system, calefacients are unsuitable in cases of active inflammation and acute fever among both horses and dogs. Amongst cattle, however, the existence of inflammation and fever must not always be regarded as sufficient to contra-indicate the use of calefacients; for in many diseases where such medicines would be destructive to other animals, they are of decided efficacy in cattle, removing irritability, subduing subacute inflammation, and inducing a healthy action of the various secretory organs.

NERVE-STIMULANTS.

Nerve-stimulants differ from calefacients only inasmuch as they act on the nervous system primarily and chiefly, and affect the action of the heart only slightly and indirectly. They exert on the nervous system specially a stimulant effect similar to that of calefacients on the circulation. Nux vomica and its alkaloid strychnia are examples of this class. They appear to irritate the spinal chord, causing in poisonous doses tetanic spasms; but do not in the first instance affect the circulation. Most calefacients, as alcohol, ether, and chloroform, when administered internally in large doses, induce exalted and perverted action of the nervous system. Nerve-stimulants are applied to many of the same uses as calefacients; but much still remains to be learnt concerning them.

ASTRINGENTS.

Astringents (*ad;* and *stringo*, I bind) corrugate the soft solids and coagulate the fluids. They include the mineral acids, and almost all metallic salts, such as alum, acetates of zinc and lead, and sulphates of zinc, iron, and copper. Astringents of vegetable origin include tannic and gallic acids, oak bark, galls, catechu, and creasote; and owe their effects chiefly to the tannin which they contain. Almost all astringents produce, in the first instance, a chemical action on the parts with which they come in contact. Thus metallic substances unite with the elements of the tissues diminishing their bulk and solubility; whilst most vegetable astringents tan them, causing their partial conversion into leather—the tough insoluble tanno-gelatine of chemists. Thus far astringents have merely a chemical action, which they exert equally on dead and living tissues. When applied to the latter, however, their chemical constringing effect is speedily succeeded by a vital constringing effect. Albuminous, fibrinous, and gelatinous tissues exposed to this twofold action become lessened in volume, their blood-vessels diminished in calibre, and their exhalations and secretions decreased. But astringents have not a local action only, most of them when properly administered become absorbed, and exercise their characteristic effects, especially on voluntary and involuntary muscular tissue. They act on the unstripped muscular fibres of the arterial and capillary vessels, rendering the pulse strong and firm; and on the same textures in the mucous membranes and glands decreasing secretion, and often promoting digestion and improving general health. In producing these effects, astringents bear a close resemblance to tonics, and in practice may often be substituted for them, or combined with them. The most marked difference between them probably consists in the action of astringents being preceded by, and resulting from, a purely chemical effect. The same substances must, however, be frequently included in both classes.

In veterinary practice astringents are used internally for arresting excessive mucous secretion, especially when depending on defective tone; and for counteracting relaxed states of the digestive organs with the morbid conditions dependant on such relaxation. Their external uses are more numerous and important. They are applied to counteract relaxation and excessive secretion both of serum and pus; to suppress pale flabby granulations; to hasten the formation of healthy cicatrices; to diminish the volume of protruded organs in order to facilitate their return, as in cases of protrusion of the rectum or uterus; to coagulate blood, and as styptics to stop the mouths of bleeding vessels; and to constringe the vessels of a part, and thus to remove inflammation—a mode of treatment specially applicable to slight contusions, conjunctivitis, and other cases of circumscribed and superficial inflammation. The internal use of astringents should be avoided in serious and extensive inflammation and fever, and in undue irritability of the alimentary canal. Their local application is usually contra-indicated where the parts are abnormally hard or dry.

EMOLLIENTS.

Emollients (*mollio*, I soften) are somewhat analogous to demulcents; but in addition to the various substances already mentioned as belonging to that class, include poultices, fomentations, moistened lint, and spongio-piline. On account of their physical or mechanical action, they soften and swell the parts to which they are applied; and in virtue of their vital action soothe and relax them. Their effects are diametrically opposed to those of astringent tonics. They are serviceable in the earlier stages of inflammation for effecting resolution; in the more advanced stages for promoting suppuration; and in all stages for relieving the outward symptoms of heat, tension, and pain. They are much used for softening and cleansing wounds, but should never be applied to those which are likely to heal by first intention.

REFRIGERANTS.

Refrigerants (*frigeo*, I am cold) reduce or moderate excessive temperature in those parts of the body with which they come into actual contact. They are much used for the removal of superficial inflammation, especially in parts of low organisation, and where the suppurative action is to be repressed. Cold air and cold water are amongst the best refrigerants that can be used; but the fact that all solid substances in becoming fluid, absorb heat, suggests the expediency of dissolving in the water immediately before application, some saline matters, as common salt and nitre, or common salt and nitrate of ammonia. Alcoholic, etherous, and other volatile fluids are also employed as cooling lotions, and are effectual on account of their abstracting heat during evaporation. Some refrigerants, especially saline ones, when given internally during fever and inflammation, are often useful in relieving thirst, and in some inexplicable manner expediting recovery; yet, as has been already mentioned (p. 20), there is no sufficient evidence of their reducing the general temperature. They appear to exert their characteristic effect only when topically applied.

SEDATIVES.

Sedatives (*sedo*, I calm, or allay) depress nervous force. They include blood-letting, aconite, prussic acid, tartar emetic, and digitalis. Applied to the mucous surfaces, to the skin, or to wounds, they find entrance into the blood, are conveyed by it to the spinal cord and nervous centres, derange and subdue the action of these parts, and consequently depress the functions of most of the vital organs, especially reducing the force and frequency of the pulse, decreasing the number of the respirations, and often causing nausea and general exhaustion. They are more uncertain in their effects than most other kinds of medicines, and more apt to be affected by modifying circumstances. They are exactly opposed to calefacients or general stimulants; and though they bear some resemblance to narcotics, they differ from them in causing no prelimininary excitation and no direct effect on the intellectual parts of the brain. In excessive doses most of them are dangerous poisons, destroying life by syncope or arrestment of the action of the heart. They are chiefly useful in reducing or controlling inordinate or irregular action of the heart, as in febrile attacks and inflammation of the lungs, intestines, and other important organs; and in subduing spasmodic affections, in which last they are most effectual when combined with alcoholic and etherous stimulants. Perhaps no remedies are so frequently abused as sedatives. They are often erroneously administered in cases of inflammation long after the acute stage, in which alone they are useful, has passed away; and also very often in cases of weakness and irritability, where the small rapid pulse indicates the necessity of tonics and stimulants rather than depletives or sedatives.

NARCOTICS.

Narcotics (νάρκωσις, *narkōsis*, a benumbing) are defined by Mr Headland as "medicines which pass from the blood to the nerves or nervous centres, which act so as first to exalt nervous force, and then to depress it; and have also a special action on the intellectual part of the brain."[1] They include such medicines as opium, Indian hemp, belladonna, hyoscyamus, camphor, and tobacco. In large doses they induce depression preceded by comparatively little excitation, and usually cause death by coma. In small doses, however, they produce very obvious excitation, and those which chiefly exhibit this effect, as opium, Indian hemp, and tobacco, form the connecting links, as it were, between narcotics and stimulants, such as alcohol and ether. In these latter, however, the primary stimulation is much greater and of longer continuance than the secondary depression, whilst exactly the reverse obtains in the case of narcotics. Some narcotics, as belladonna and hyoscyamus, closely resemble sedatives, being preceded by but slight excitation, and having little action on the functions of the brain proper.

Among horses and cattle narcotics require to be given in unusually large doses, and at best act far less certainly and perfectly than in the human subject or the dog. During the preli-

[1] Prize Essay on the Actions of Medicines, p. 222.

minary stage of excitation among animals, they appear to exalt chiefly the functions of the spinal cord, causing spasms, and convulsions; whilst in the same stage in man they act more particularly on the mental powers, on the special senses, and on volition and sensation. During the succeeding stage of depression, drowsiness and stupor are also less obvious in the lower animals than in man; and death is more apt to occur from apnœa or syncope than from coma.

Narcotics are given to relieve inordinate nervous action. They are specially serviceable in removing the spasms of colic and chorea; in alleviating the irritability of chronic coughs, bronchitis, tetanus, gastrodynia, or chronic vomiting in dogs, diarrhœa, and dysentery; and in blunting the pain of severe wounds, rheumatism, pleurisy, and other acute inflammations. When thus used for the relief of pain they are usually termed *anodynes*, and when they cause sleep, *hypnotics*. To ensure their full effect, they should be given at intervals of every one or two hours; and since their effects are apt to diminish with their continued administration, they should be administered in gradually augmented doses.

ANÆSTHETICS.

Anæsthetics (*α*, *a*, privative; and *αἴσθησις*, *aisthēsis*, sensation) are agents which produce insensibility to external impressions and to pain. They might be considered merely as a subdivision of narcotics, which they resemble in general action. As, however, they possess a peculiar distinctive power of extinguishing sensation, I shall briefly consider them under a separate paragraph.

In an excellent paper on anæsthesia and anæsthetic agents in the British and Foreign Medico-Chirurgical Review, Vol. IX., anæsthetics are classified as follows:—

1. Protoxide of azote, NO.

2. Carbonic oxide, CO; carbonic acid, CO^2.

3. Light carburetted hydrogen, CH^2; olefiant gas, $C^2 H^2$; coal gas.

4. Ethyle series:—Alcohol, $C^4 H^5 O+HO$; sulphuric ether, $C^4 H^5 O$; nitric ether, $C^4 H^5 O+NO^3$; acetic ethers, $C^4 H^5 O+C^4 H^3 O^3$; hydrochloric ether, $C^4 H^5 Cl.$; hydrobromic ether, $C^4 H^5 Br.$; hydriodic ether, $C^4 H^5 I$; formic ether, $C^4 H^5 O+C^2 HO^3$.

5. Acetyle series:—Aldehyde, $C^4 H^3 O+HO$; Dutch liquid, $C^4 H^3 Cl.+Cl. H$; and doubtless the corresponding iodide and bromide.

6. Formyle series:—Chloroform, $C^2 H Cl.^3$; bromoform, $C^2 H Br.^3$; iodoform, $C^2 H I^3$.

7. Compounds of methyle:—Pyroxylic spirit, or wood naphtha, $C^2 H^3 O+HO$; rock naphtha, $C^4 H^5$; coal naphtha; formmethylal (uncertain composition); methylal, $C^2 HO, HO+2C^2 H^3 O$.

8. Turpentine, $C^{10} H^8$; benzoyle, $C^{12} H^6$; camphor, $C^{10} H^8 O$; creasote, $C^{14} H^7 O^2$.

9. Bisulphuret of carbon, CS^2; acetone, $C^3 H^3 O$.

10. False anæsthetics, as sulphuretted hydrogen, prussic acid, coneine, etc.

11. Mixed bodies, as oleum etherum, chloric ether, etc.

It is impossible at present to do more than advert very briefly to the most important of these. Mr Nunneley, who has made many careful and valuable observations on anæsthetics, considers nitrous oxide unsafe and uncertain. The substances of the second class, though extinguishing sensibility, are too poisonous to be of any practical value as anæsthetics. Light carburetted hydrogen is very feebly anæsthetic; olefiant gas is more powerful, though not very safe; but coal gas appears both safe and effectual, and in some experiments on horses, made a few years ago at the Edinburgh Veterinary College, it acted almost as well as chloroform, leaving, however, considerable nausea and depression. None of the ethers are so good as the sulphuric, to which we shall afterwards advert. Aldehyde is tolerably active, but objectionable on account of its irritant properties.[1] There seems much difference of opinion regarding the Dutch liquid. Mr

[1] Anæsthesia in Surgery and Midwifery, by Professor Simpson. Philadelphia, 1849, p. 211.

Nunneley's experiments on animals lead to the inference that it is as effectual as chloroform; but Professor Simpson and Dr Snow regard it as a deleterious preparation. It is not likely, however, to come into common use, as it is very costly, and apt, when long inhaled, to leave much nausea. Among the bodies of the formyle series, none are equal to chloroform, which is, indeed, the best of all known anæsthetics, and will afterwards be fully noticed in its proper place. Pyroxilic spirit is very feebly anæsthetic, resembling alcohol in this as in its other properties. Coal naphtha (C^{14} H^{13}), also called Tennant's anæsthetic liquid, is much more effectual, and, besides being safe and manageable, is, I think, superior to all other anæsthetics except chloroform, and probably ether. Turpentine, and the other bodies associated with it, "possess the feeblest anæsthetic powers, or these are accompanied with such irritant qualities as render their use quite inadmissible."[1] Bisulphuret of carbon, though tolerably active, is very disagreeable to inhale, and not always very safe.[2] Acetone is unfit for use, on account of its acrid and irritating properties. The so-called false anæsthetics destroy sensibility only when they are given in poisonous doses.

Although the first employment of any of these substances in general practice is only of very recent date, still the possibility of inducing anæsthesia seems to have been thought of at a very early period. Mandrakes are spoken of by Dioscorides as having been used in his time for causing insensibility to pain. And, about the end of the seventeenth century, Augustus II., King of Poland, underwent an operation, which, on account of the use of some secret agent, is said to have been unaccompanied by pain.[3] In the beginning of the present century, Sir Humphrey Davy proposed nitrous oxide as a means of causing insensibility. About 1831, ether was known to have the power of causing insensibility among the lower animals, and relieving asthma in the human subject. It was first used to produce anæsthesia in man in America, on the 30th September 1846, by a Mr Morton, in

[1] British and Foreign Medico-Chirurgical Review, Vol. IX., art. cit., p. 182.
[2] Anæsthesia in Surgery and Midwifery, by Professor Simpson, pp. 211-13.
[3] British and Foreign Medico-Chirurgical Review, Vol. IX., art. cit., p. 149.

the extraction of a tooth, and shortly afterwards became general in all kinds of surgical operations. On this side the Atlantic, it was first used in London on the 19th December by a dentist, and on the 21st by the celebrated Liston. In the succeeding February, it was first applied in midwifery by Professor Simpson of Edinburgh. Before, however, another year had elapsed, that gentleman had discovered another anæsthetic, more potent, safe, and convenient than any hitherto tried—this was chloroform. It had been previously known for some time as a chemical curiosity, and some of its effects on the lower animals had been observed by Dr Mortimer Glover in 1842, and by Flourens in March 1847. But its power of producing anæsthesia in man was first discovered on the night of the 4th November 1847, by Professor Simpson, in an experiment made with a small quantity on himself and some friends.[1] Since that date, its employment has spread over all parts of the habitable globe—it has relieved the sufferings of many thousands, and has saved the lives of hundreds, probably of more than ever have been saved by any single remedy, however ancient or valuable. Since the discovery of chloroform, many other anæsthetics have been tried, but none of them have come into general use.

The symptoms of anæsthesia in the lower animals do not materially differ from those in man. Indeed, Dr Marshall Hall thinks that their effects are more perfect in the lower animals. In the first stage, salivation and coughing often occur, the respirations are deep and somewhat hurried, the pulse quickened, the surface-heat raised, and the limbs moved about irregularly. During this stage in man, peculiar sensations and sounds are perceived, incoherent expressions are uttered, and a strong desire to continue the inhalation is exhibited. In all animals, extreme slowness of the pulse, general insensibility, and muscular relaxation, gradually supervene. If the use of the anæsthetic be still continued, the breathing becomes stertorous, the pulse slow and weak, and unless the inhalation be immediately stopped, death soon results. Irregular, and even untoward effects sometimes take place,

[1] Miller's Principles of Surgery, Second Edition, pp. 757-758.

with certain anæsthetics, and in some subjects. Vomiting, and subsequently diarrhœa, convulsions, and relaxation of the various sphincters, are occasionally observed. In young animals the effect is usually very prompt and powerful, and sometimes accompanied by dangerous depression of the heart's action. In dogs there is sometimes whining, as if the animal were uneasy or suffering pain; and in all animals there is apt, even during the full action of the agent, to be a quivering of the muscles, which renders the performance of delicate operations somewhat difficult. The effect varies in duration according to circumstances, but may be maintained for a very long time with perfect safety. Both in man and the lower animals, it has been kept up for many hours continuously. The degree of anæsthesia which it is advisable to produce, necessarily varies much in different circumstances. When a painful operation is to be performed, the agent should be given until the patient is quite unconscious and insensible, but where merely relief of pain or irritation is sought, a much less degree of effect is sufficient.

Anæsthetics appear to produce their effects in a tolerably regular order, in consequence of the different parts of the nervous system being progressively affected. At first there is exalted and perverted action of the intellectual faculties, the special senses, and volition, depending on a disturbed and excited state of the cerebrum and cerebellum. But the functions of these parts speedily become depressed, giving rise to drowsiness and suspension of special sense and motive power. After some time the functions of the thalami optici, and other sensory ganglia, and to some extent those of the spinal chord, are paralysed, and the extinction of common sensation thereby induced. Thus far anæsthesia may be carried with safety and with decided advantage where insensibility to severe pain is required; but if it be still prolonged the functions of the medulla oblongata become so much impaired that respiration ceases, and the action of the heart is also in consequence soon arrested. Death usually depends on arrestment of the pulmonary circulation; and perhaps occasionally on cessation of the action of the heart. The post mortem appearances closely resemble those of drowning. The lungs and other parts of the pulmonary apparatus are much congested, the right side of the heart is filled with imperfectly purified blood, and the membranes of the brain are generally vascular.

The most certain, rapid, and safe way of administering anæsthetics is by inhalation. The chief precaution necessary is to secure their being mixed with a sufficiency of air, for, if breathed alone, they speedily cause asphyxia. Where they have produced an undue effect the best restoratives are plenty of fresh air, and if requisite, artificial respiration. Until partial recovery takes place, the patient is unable to swallow, and hence any attempt to administer stimulants is dangerous. When injected into the rectum their anæsthetic effects are preceded by an inconvenient amount of excitement, are longer continued, and more difficult to subdue. This mode of administration appears, however, peculiarly suitable in irritable, spasmodic, or painful diseases of the intestinal or urinary organs. Local anæsthesia was at one time thought capable of important practical applications, for it was observed that if any part or section of the bodies of earth-worms, centipedæ, or other creatures low in the scale of being, be wetted with chloroform or ether, it became entirely deprived both of sensation and motion. In all the higher animals, however, the nervous and vascular connection between different parts of the body is so intimate that it is impossible, by any local means, to extinguish the feeling of any single part of the body.

No satisfactory explanation has yet been given of the *modus operandi* of anæsthetics. They all of them enter the blood, and have a most remarkable power of penetrating the tissues. Some suppose that they cause sudden and temporary asphyxia; others, that they prevent the conversion of venous into arterial blood; others again, that they add carbon to the blood; and others, that they destroy (in some inexplicable way) the power of the nerves to convey, and of the brain and nervous centres to receive, sensation. The anæsthetic state, though somewhat analogous to that of alcoholic intoxication, differs from it in many essential particulars. With alcohol, the disorder of the mental functions is always very great as compared with the slight loss of sensibility; and the effect is more decidedly marked when the agent is introduced into the stomach rather than into the lungs. Exactly the reverse obtains in the case of anæsthetics.[1]

Anæsthetics are less used in surgical and other painful operations in the lower animals than in man, on account of the larger quantities required, the difficulty of administration, and the undue prolongation of the preliminary stage of excitement. They have been used in parturition, and afford, as in the human subject, immunity from pain, but without apparent interference with the force or frequency of the involuntary contractions of the uterus. They have further been used for relieving the irritability and pain of such diseases as peritonitis, pleurisy, and pneumonia; for removing the spasms of tetanus, colic, and asthma; and for alleviating, by local application, the irritability of severe wounds. For all such purposes their use might, with advantage, be much extended.

IV.—THE CIRCUMSTANCES WHICH MODIFY THE ACTIONS OF MEDICINES.

The actions of medicines are modified both in nature and degree by many circumstances—some dependent on the medicines itself, as its quantity, quality, and form of administration; and others dependent upon the patient, as his species and age, and also the channel by which he receives the medicine. To some of these we shall now briefly advert.

Quantity.—Variations in the quantity of the medicine, or as it is technically called, the *dose*, evidently alter the degree, and occasionally, also, the kind of action. Small doses of turpentine cause diuresis; somewhat larger doses have a general stimulant effect; while those which are still larger act chiefly on the bowels. Small doses of most salts of potash, soda, and magnesia, are diuretic, while larger quantities are purgative. Aloes, in small quantity is tonic, and in large, purgative. Alcohol, opium,

[1] British and Foreign Medico-Chirurgical Review, vol. ix. p. 178.

and many other substances afford striking examples of medicines, in which a variation in dose produces a difference in the nature of the effect. An increase of the time during which the medicine is applied is generally equivalent, in the case of topical remedies, to an increase of dose, as with mustard, cantharides, and nitric acid. Where a uniform and continued effect is required, as in the case of tonics and stimulants, frequent small doses are preferable to large doses given at long intervals. That the effects of medicines begin and terminate with their administration, may be regarded as a general rule, subject, however, to occasional exceptions. Lead, mercury, and digitalis, for example, are often given for some time without any obvious result, but afterwards produce their effects suddenly and violently, as if from the combined or accumulated action of a series of doses, and frequently continue them some time after the administration of the remedy has ceased. Medicines exhibiting these phenomena are said to be *cumulative* in their action.

Quality.—The quality of medicines must obviously affect their actions. Medicines that are impure, adulterated, or badly kept, cannot be expected to have such certain and powerful effects as those which are pure, carefully prepared, and well preserved. To protect medical men and the public against the falsification of drugs, the pharmacopœias, especially that of Edinburgh, have introduced a series of tests, by which the purity of all the simple substances in the Materia Medica may be tested.

Form of Administration.—The form in which a medicine is administered often modifies its effects. Thus, a state of fine division, by facilitating absorption, materially expedites and increases the action of medicines, which consequently present a variable and decreasing activity according as they are given in the gaseous, fluid, or solid forms. Chemical combination, by altering the solubility of a medicine, frequently causes a variation in the degree of its action. It impairs, and often entirely neutralises the activity of medicines, which, like the mineral acids and alkalies, have only topical effects, whilst it alters but slightly those which become absorbed and exercise a more general action. Thus the combination of morphia, quinine, or oxides of lead, iron, or copper, with different acids, does not sensibly affect the action of these bases, or at most modifies only the degree of their action by increasing or diminishing their solubility.

Most vegetable substances are liable to be modified by soil, climate, cultivation, and many other circumstances. Such modifying influences will, however, be more conveniently noticed when discussing those medicines which they specially affect. Medicinal plants are usually most active when indigenous; but the opium-poppy, liquorice, and tobacco, are notable exceptions to this rule. Wild specimens are usually superior to cultivated ones, and should, at all events, be preferred until the other be proved of equal efficacy. Selection should be made of vigorous, well-formed, dark-coloured, but not excessively luxuriant plants, growing on dry soils, and exposed to air, light, and sunshine, except in the case of plants which naturally seek situations of an opposite kind.

Species of Patient.—The different classes of veterinary patients are very differently affected by many medicines. A few grains of tartar emetic cause almost immediate vomiting in dogs, whereas the same medicine, even when given in doses of several ounces, has scarcely any physiological effect on horses or cattle. Aloes, the most uniform and convenient purgative for horses, is uncertain and irregular in its action on cattle, but purges dogs in doses of about a drachm, or about twice as much as would kill a man. Opium, strychnia, and ether also afford good illustrations of the different effects which the same medicine has on different classes of animals. In the present state of our knowledge, some of these anomalies cannot be very satisfactorily accounted for, but most of them depend on differences of organisation and habit; and to a few of these we shall now briefly advert.

In the horse, the alimentary canal is very extensive, highly vascular, and abundantly supplied with nerves—provisions which, while they insure the thorough absorption of nutriment from bulky and comparatively innutritious food, render the animal peculiarly liable to superpurgation, and unusually apt to suffer from inflammation of the bowels. In the horse, vegetable purgatives appear more suitable than mineral ones, and act chiefly on the large intestines, and only slightly on the stomach and small intestines. Except in disease, and under the influence of aconite, and some few other poisons, horses never vomit; the act of vomition being prevented in them by the smallness of the stomach, its distance from the diaphragm and abdominal muscles, and the consequent difficulty with which it can be compressed betwixt the two. Most substances which act as emetics for men and dogs, produce a sedative effect when given to horses in sufficient doses. Sudorifics are less active and less useful than in man, and are very apt to act on the kidneys, unless the animal be well clothed. Opium and other narcotics operate less powerfully on horses, and, indeed, on all the lower animals, than on man.

The peculiarities of the action of medicines in cattle are chiefly referable to the construction of their alimentary canal, and to their phlegmatic temperaments. In these ruminants, the stomach is quadrisected, is much less vascular than in most other animals, is chiefly covered with cuticular mucous membrane, and (as regards its three first divisions) is almost mechanical in its action. The first and third compartments of the stomach always contain food, often in large quantity. These facts explain why cattle require such large doses of all medicines, why irritant and corrosive poisons can be given them with impunity, even in very large doses, and why purgatives, unless in large doses and in solution, are so tardy and uncertain in their effects. Their kidneys and skin are somewhat less easily acted on than the corresponding organs in the horse; and their dull and phlegmatic disposition resists the action both of stimulants and tonics. Sheep closely resemble cattle in the way in which they are affected by most medicines.

Medicines generally operate on dogs much in the same way as on man, but there are some remarkable exceptions to this rule. Dogs, for instance, take with impunity about twice as much aloes as would kill a man, but, on the other hand, would be destroyed by half as much calomel or oil of turpentine as are usually prescribed for a man. The opinion generally held, that medicines may be given to dogs in the same doses as to men, cannot therefore be safely entertained without a good many reservations. In dogs, the alimentary canal is short and straight, and purgatives consequently act with greater rapidity than in any other veterinary patients. Another peculiarity is the facility with which they can be made to vomit. Indeed, vomition in dogs is often naturally produced by their eating various sorts of grass. The kidneys are excited with more difficulty than in horses or cattle, and diaphoresis can scarcely be said to occur at all—the skin not being adapted for cutaneous transpiration. The actions of medicines on pigs is somewhat similar to their action on man, but the practitioner is seldom required to prescribe for these animals.

Age.—The properties of medicines are modified, especially in degree, by the age of the animal. As a general rule, the younger the animal, the more easily is it affected. Some authors have constructed tables showing the doses suitable for animals of different ages. Thus Bourgelât estimates that a one-year old colt requires one-third of the quantity of any medicine given to an adult horse; a two-year old, one-half; and a three-year old, two-thirds. A similar ratio is applicable to cattle. Such calculations are, however, merely approximative.

Size.—The size of the patient must obviously affect the action of all remedies, but the regulation of this modifying circumstance must be left to the judgment of the practitioner. In this work, the doses mentioned under the head of each substance are, unless otherwise stated, those suitable for adult animals of medium size.

Mode of Exhibition.—The channel by which medicines enter the body, frequently modifies the degree of their action, for different organs and tissues vary much in their powers both of absorption and decomposition. Medicines are readily absorbed from the mucous and serous surfaces, from cellular tissue, and from wounds. They have also sometimes been injected into the veins, when they act with remarkable rapidity and effect; but this method of exhibition is attended with too much trouble and risk to be of any practical utility. When given by the mouth, most medicines are taken up from the surfaces of the stomach and first part of the small intestine—parts which afford great facilities for speedy and complete absorption, and are, moreover, very sensitive, and intimately connected, both by vessels and nerves, with all the important organs in the body. The surface of the rectum is less sensitive and vascular than that of the stomach, and hence most medicines may be given *per ano* in doses two or three times as large as those administered by the mouth. The pulmonary mucous membrane is very actively absorbent, and well adapted for conveying medicines into the system. This method of administration, now in everyday use with such substances as chloroform and ether, might probably be advantageously extended to many active non-volatile medicines, which could be introduced into the lungs along with the vapour of water or of other fluids. Such a plan would be of great practical value, for medicines so introduced into the body, being speedily brought in a finely divided state into immediate contact with the blood, act with great rapidity and certainty. In most animals the skin is capable of absorbing many medicinal substances. Solutions of opium, tobacco, arsenic, and corrosive sublimate, when ignorantly or carelessly applied for the cure of skin diseases or such other purposes, frequently become absorbed, and hence develop their poisonous action. Absorption is, however, greatly facilitated by removing the cuticle, by means of a small blister, and applying the medicine directly to the true skin. This constitutes the *endermic* method of exhibition, and has been tried with quinine, strychnia, morphia, and other expensive medicines, which, when so used, are said to operate in unusually small doses.

Habit.—The continued use of a medicine alters the degree of its action, and affects organic rather than inorganic medicines.

Opium, and most general stimulants, when administered for some time, gradually lose their effects; while caustics and irritants, which exercise only a topical action, exhibit, on their repeated application, a gradually increasing activity.

Idiosyncracies, which in the human subject render some poisons almost innocuous, and some simple medicines deadly poisons, are much less frequent and notable among the lower animals. Those of most frequent occurrence among veterinary patients, are either an increased or a diminished susceptibility to the action of purgatives and diuretics.

Diseases.—The existence of disease alters the susceptibility of the system to the action of many medicines. Influenzas, low fevers, and most extensive inflammations of mucous or cutaneous surfaces, withstand antiphlogistics badly, and require for their successful treatment the early exhibition of unusually large doses of tonics and stimulants. Copious blood-letting and large doses of sedative medicines induce less depression in inflammatory fevers than in health; immense quantities of opium have scarcely any effect in tetanus, hydrophobia, or enteritis; and excessive doses, both of purgatives and stimulants, are tolerated in the apoplectic form of puerperal fever among cattle, and in all other cases in which there is depression of nervous force.

External Circumstances.—The circumstances in which patients are placed, have often a material influence in altering the actions of medicines. Thus, it is notorious that diseases, whether in horses, cattle, or dogs, when occurring in large towns, and in filthy, overcrowded, and badly ventilated houses, are unusually unmanageable, particularly apt to assume chronic and untoward forms, and especially difficult of treatment. Owing to the altered and perverted state of the vital functions, induced by continuous disregard of the laws of health, medicines in such cases act very slowly and imperfectly, and will operate effectually only when used conjointly with improved sanitary arrangements.

SECTION II.

ON VETERINARY PHARMACY.

In the present section I shall briefly notice the more important pharmaceutical compounds used in veterinary practice, as powders, boluses, tinctures, extracts, etc., adverting chiefly to the best methods of making, preserving, and administering them. I shall conclude these general observations with a few remarks on weights and measures.

POWDERS.

Most medicines may be coarsely powdered in a common hand mill, such as that in ordinary use for grinding coffee or pepper, or in an iron mortar (which should be fixed into a block of wood) with a large, heavy iron pestle, which ought to be suspended from one end of a flexible rod running along the roof, and fixed into the opposite wall. When the powder is to be finely divided it must be transferred to smaller mortars, which may be made of wood, marble, or wedgewood-ware. Those of the latter material are the most convenient, being cheap, easily kept clean, and little affected by acids. They should be kept of several different sizes. The most easy and expeditious way of reducing a substance to powder is to put only a small quantity of it into the mortar at a time. When a fine state of division is required, the powder is sometimes put through a sieve, and the coarser particles returned to the mortar. The laboratory should always contain sieves of different sizes and degrees of fineness, some of wire-gauze, and others of horse-hair. For light pungent or irritant powders compound sieves are sometimes useful. They are merely common sieves entirely closed in with a lid both above and below. If it can be at all avoided, medicines, especially the more expensive vegetable preparations, should not be purchased in powder; for in that state they are very apt to contain adulterations and impurities, which are then, for the most part, unusually difficult of detection. Medicine is occasionally administered in the state of powder scattered over, or mixed with, the food; but this method of administration is only admissible in the case of very simple and tasteless remedies, and should not be relied on where a decided or speedy effect is desired.

BALLS—BOLUSES.

Balls correspond in veterinary practice with the pills used in human medicine. They are of a cylindrical form, and usually contain, besides the active ingredients, certain subordinate constituents, termed *excipients*, which are added to give the bolus cohesion and consistence. The most common excipients are linseed meal and water, oil, lard, soap, liquorice powder, treacle, syrup, conserve of roses. In the selection of suitable excipients, the choice must be determined entirely by the nature of the active ingredients. The first four excipients above mentioned are chiefly used when the bolus or mass is intended for immediate use; but when it is to be kept for any considerable time, some of the others are more suitable. In order to keep a mass long soft and moist, it is often advisable to add to it a small quantity of some diliquescent alkaline salt—as acetate of potash, which serves especially well for most diuretic masses. When the active principles are resinous, a little alcohol or oil of turpentine is a useful addition, as, for example, in making the aloetic mass. In preparing a ball mass, the various ingredients are sometimes mixed together in a mortar or on a slab; but the aid of heat is sometimes necessary, as when any of the materials are of a waxy or resinous nature. A good ball mass is sometimes very troublesome to make, for it must be soft, and yet possessed of a proper consistence and cohesion, must retain these properties though kept for a considerable time, and must further be so prepared that each dose shall make a properly sized ball. It should be preserved in jars covered with moistened bladder and stout paper, and should be made up into doses only as required, for when balls are long kept they are apt to get hard, and in this state act tardily and uncertainly, sometimes passing unchanged through the whole extent of the alimentary canal. For cleanliness and facility of administration, balls are given either rolled up in soft paper, or covered with a coating of gelatine—a very neat and convenient method of exhibition. For horses the bolus is the most common and convenient method of administration; and for dogs it is also often used. It is given to horses either with the balling iron or with the fingers; and the latter method is the better, except in animals with very small, narrow mouths, or in which the mouth cannot be sufficiently opened. The operation, with a little practice and dexterity, may be easily performed. The ball is held by one end between the thumb (which supports it below) and fingers of the right hand, which is drawn together and rounded as much as possible. The patient's tongue is gently drawn out a little way by the left hand, and the ball passed rapidly along the roof of the mouth, and dropped on the back of the tongue, which is at once let loose and the mouth closed.

DRAUGHTS—DRENCHES—DRINKS.

Drenches are usually extempore preparations. They are occasionally given to horses, especially when a speedy effect is desired, as in colic; are frequently prescribed for dogs; and are almost the only form in which physic is ever given to cattle or sheep. In these ruminants medicines in the solid state act very tardily and imperfectly, for they get mixed up with the immense bulk of food always found in the rumen, and thus remain unabsorbed often for a long time. Some medicines, too, from prolonged contact with this mass of vegetable matter, probably undergo changes which materially interfere with their action. Medicine in a liquid form, however, comes immediately into intimate contact with a large absorbing surface of mucous membrane, and passes on more speedily towards the second and fourth stomachs. In preparing drenches, care must be taken that the different ingredients are not incompatible, decomposing or injuriously reacting on each other; and further, that their quantity be not too great, as the trouble of administration is thereby much increased. For dogs, two to six ounces, according to the size of the animal, is an average amount; for horses, one to two pints; for sheep, four to six ounces; but for cattle it is not so necessary to limit the proportion of fluid. In giving the medicine the head should be slightly raised, which in horses may be conveniently done with the aid of a twitch, the noose of which is placed over the animal's upper jaw within the incisor teeth, and the stick held by an assistant, standing on the left side of the patient. In cattle, the head should also be steadied by an assistant, who holds either the horns or ears; and in dogs, the jaws may be kept sufficiently apart by getting some one to put a loop of tape or string over each jaw, and gently separating them, when the medicine may be readily poured over. In all animals the nostrils must be left unobstructed, and the tongue loose, or only slightly pressed on by the operator's left thumb. The fluid should always be carefully and slowly given; and if coughing occurs, the operation should be stopped, and the animal set free for a few minutes.

DECOCTIONS.

Decoctions are prepared by *boiling* solid substances, especially of vegetable origin, in water. To ensure perfect solution, the medicine should be bruised or cut into small pieces, and the fluid allowed to stand on it for some time; but excessive heat and prolonged boiling should be carefully guarded against. The insoluble parts are separated by filtering the mixture through bibulous or unsized paper, straining it through muslin or calico, or allowing it to settle, and then pouring off the supernatant fluid. When decoctions are to be kept for some time, they should have a little spirit added to them, and be bottled and well corked *while hot.* Without these precautions, such preparations are very apt to ferment, or otherwise become spoilt. *Examples*—Decoction of barley, of camomile flowers, etc.

INFUSIONS.

Infusions do not differ materially from decoctions. They are made by digesting the substance either in hot or cold water, and separating the insoluble parts by decanting, filtration, or straining. The process is often conducted in stoneware jugs, provided with a cup with perforated sides and bottom fitting into the top of the jug, extending about half-way down, and containing the solid matters to be infused. With such an apparatus, infusions are very easily and conveniently prepared; but, unless well bottled and corked up when hot, they do not usually keep well. An infusion which will keep better may be got by percolating cold water through the substance packed in an apparatus similar to that used for making tinctures. *Examples*—Infusion of catechu, gentian, aloes, etc.

TINCTURES.

Tinctures are solutions of animal, vegetable, or mineral substances, in any spirituous fluid. Alcohol, in some of its various degrees of concentration, and occasionally sulphuric ether, are the spirituous fluids generally used. The Edinburgh Pharmacopœia gives the following excellent directions for making tinctures:—

"Tinctures are usually made by reducing the solid ingredients to small fragments, coarse powder, or fine powder, macerating them for seven days or upwards in proof-spirit or rectified spirit, straining the solution through linen or calico, and finally expressing the residuum strongly to obtain what fluid is still retained in the mass. A much superior method, however, has been lately introduced, which answers well for most tinctures, namely the method of displacement by percolation. According to this process, the solid materials usually in coarse or moderately fine powder, are moistened with a sufficiency of the solvent to form a thick pulp; in twelve hours, or frequently without any delay, the mass is put into a cylinder of glass, porcelain, or tinned iron, open at both ends, but obstructed at the lower end by a piece of calico or linen, tied tightly over it as a filter; and the pulp being packed by pressure, varying as to degree with various articles, the remainder of the solvent is poured into the upper part of the cylinder, and allowed gradually to percolate. In order to obtain the portion of the fluid which is kept in the residuum, an additional quantity of the solvent is poured into the cylinder until the tincture which has passed through equals in amount the spirit originally prescribed; and the spirit employed for this purpose is then recovered for the most part by pouring over the residuum as much water as there is of spirit retained in it, which may be easily known by an obvious calculation in each case. The method by percolation, where applicable, will be found much more convenient and expeditious than the mode hitherto commonly followed, and it exhausts the solid materials in general much more completely. As considerable practice, however, is required for managing the details in different cases, more especially in regard to the degree of minuteness of division of the solids, and the degree of firmness with which they are to be packed in the cylinder, we have thought it right to direct that the method by maceration may be followed as an alternative. But the method of percolation is now preferred by all who have made sufficient trial of it to apply it correctly."

In this process of percolation the spirit passes gradually through the solid materials, in a state of moderately fine division, displaces and dissolves out their soluble parts, filters through the linen or calico at the lower part of the cylinder, and passes off by the stop-cock which should be attached to the apparatus. Tinctures are very convenient preparations; they are usually tolerably concentrated, and are well adapted for long keeping. *Examples*—Tinctures of aloes, myrrh, opium, and cantharides.

EXTRACTS.

Extracts are the soft, semi-solid residues left by evaporating decoctions, infusions, tinctures, or the natural expressed juices of plants. What is chiefly necessary in their preparation is to avoid exposing them to high temperatures, which are very apt to decompose or volatilise their active principles—accidents which are especially apt to occur with narcotic plants, but which may be entirely prevented by first getting rid of a quantity of the fluid matters by evaporation in vacuo, and then transferring the residue to flat shallow pans, in which it is exposed to currents of air at ordinary temperatures, and continually stirred until it arrives at the desired consistence. Both alcohol and water are used in making the solutions from which extracts are subsequently prepared; and the best solvent in each particular case, is that which removes the active principles without acting on the starch, gum, or other matters, which not only uselessly increase the bulk of the preparation, but also render it apt to spoil. When extracts are well made, they keep for a long time without undergoing change, especially if occasionally moistened with a little rectified spirit. *Examples*—Extracts of belladonna, hemlock, digitalis, liquorice, aloes, etc.

MIXTURES.

Mixtures are fluids containing two or more ingredients, either chemically combined or mechanically commingled. They usually are thick and drumly, deposit a sediment on standing, and are prepared extemporaneously. Camphor, chalk, and catechu mixtures, are examples of this sort of preparation.

ELECTUARIES.

Electuaries are generally made with sugar or mucilage; are thick, viscid, and of the consistence of treacle; and are chiefly used as vehicles for the administration of insoluble and disagreeably tasted drugs. They are usually regarded as synonymous with conserves and confections, and are rarely used in veterinary practice. *Examples*—Electuaries of catechu, senna, and opium.

SYRUPS.

Syrups are saccharine solutions, of a density varying between 1300 and 1400. In preparing them, care must be taken that they be of a proper consistence, for if too thin and weak, they become mouldy, and are apt to ferment; and if too thick and strong, the sugar crystallises out. Simple syrup, the one most commonly used in veterinary practice, consists of two parts of sugar and one of water. Syrup of poppies and syrup of buckthorn are also occasionally used.

LOTIONS.

Lotions are fluid preparations intended for external use, and generally made up extemporaneously. Lotions for the eye are usually called *collyria*.

OINTMENTS.

Ointments are preparations for external use, containing oleaginous or waxy matters, and about the consistence of butter. When lard or oil are the excipients, the several ingredients may be mixed in a conveniently sized mortar; but when wax or resin is used, it must be melted over a slow fire; the other constituents are then added, and the whole mass stirred until it has acquired a proper consistence. Ointments should be kept in well closed pots or jars, which (except when in daily use) should be covered with moistened bladder and strong paper. They are generally dispensed either in little wooden boxes, or in earthenware pots—both of which the practitioner should have of several different sizes. In dispensing these, and other officinal preparations, spatulæ will be found essential articles of the laboratory furniture. They should be of different sorts, some being made of steel, and others of bone, wood, or horn. *Cerates* are ointments containing wax; and *liniments*, ointments containing oil, and of a mediate consistence between ointments and oils. It is scarcely necessary to give examples of this class of preparations. The following are in everyday use—ointments of sulphur, cantharides, and mercury.

PLASTERS.

Plasters consist of waxy and resinous matters spread on calico, linen, leather, or some such substances. They are less useful in veterinary than in human practice; for in the lower animals they are difficult to apply, and, from the greater power of the panniculus carnosus, are very apt to be displaced. Where they are required to remain on for some time, the best way is to apply the melted ingredients of the plaster directly to the skin, covering them first with a little teased tow or lint, and then with a linen or leathern bandage. Plasters of this kind are generally known under the name of *charges*, and were once much used in all kinds of lameness. Their application was often beneficial, not so much, however, from their inherent effects, as because they rendered it necessary that the animal to which they were applied should cease from working for several weeks or months.

FOMENTATIONS.

Fomentations are watery applications used for bathing any part. They often consist of water alone, but vinegar, salt, and various other medicinal substances are sometimes added. Unless otherwise specified, they are applied hot. Their exact temperature cannot, however, be regulated by any very definite rules, and must be modified by the nature and extent of the malady, and the part of the body to which they are applied. When for the eye, they may be about 100° or 120°; for strains, weed, and such cases, they should be as hot as the hand can bear; and for enteritis, pleuro-pneumonia, or other cases in which they are intended to produce counter-irritation, they must, to do much good, be scalding hot. In these latter cases, sacks, flannel, or horse-cloths should be dipped into boiling water, slightly wrung, and then laid over a large extent of surface contiguous to the parts diseased; or, what is usually more effectual, the parts should be covered with several folds of thick woollen stuffs, and boiling water repeatedly poured in betwixt them and the skin. In most ordinary cases, fomentations are made with a sponge or a soft piece of rug. They are chiefly useful for cleansing and softening wounds; for relieving external or superficial inflammation, with its attendant symptoms of heat, pain, and swelling; and also for reducing internal inflammation, as that of the respiratory organs or the bowels, by speedily causing counter-irritation. The chief disadvantage in the use of fomentations is their not being applied sufficiently long. Their application is often withdrawn before the heat and moisture have time to do any good, and the part is rapidly cooled by evaporation and contact with the cold external air. To effect the full amount of good of which fomentations are capable, they should be applied for several hours; fresh supplies of water, of the requisite temperature, being had in abundance. After the operation is finished, the parts should be rubbed dry, and well clothed, so as to prevent the rapid diminution of temperature which would otherwise ensue from evaporation.

POULTICES—CATAPLASMS.

Poultices are external applications of a soft and pulpy consistence, and are usually intended to act locally. They are applied either hot or cold. Hot poultices are commonly made of linseed meal, bran, or oatmeal, with a sufficiency of boiling water to bring them to a suitable consistence; or of carrots or turnips, either steamed or boiled. Hot poultices are efficacious in allaying pain and irritation, in reducing circumscribed and superficial inflammation, and in promoting suppuration. They soften and relax the surfaces with which they come in contact, and increase the circulation of blood through them. But, as they are apt to hurry on the suppurative process, they are unsuitable for wounds which, if let alone, would heal by first intention or adhesion, and for cases of long-standing inflammation, where the parts have become relaxed and deficient in tone. In such cases, cold applications are indicated.

Cold poultices are made of the same materials and in the same way as hot poultices, and are then allowed to stand until they become cold. Their temperature is sometimes farther reduced by pouring over them vinegar and water, sour milk, solutions of equal parts of nitre and salammoniac, or of common salt and nitrate of ammonia, or some other of the many so called "freezing mixtures." These cold poultices are especially adapted for sub-acute and chronic inflammation, particularly of joints, ligaments, tendons, and feet, and all other parts of comparatively low organization. They are even more useful in arthritic and feet diseases of cattle than those of horses; and are often of much benefit in cases which have for some time been ineffectually treated by hot applications. In veterinary practice it is very difficult to get poultices properly and securely applied, and it is only by much consideration, ingenuity, and mechanical dexterity, that this inconvenience can be overcome. Another difficulty is to keep the poultices at a uniform temperature, which may sometimes be done by pouring over them hot or cold solutions, but most effectually by getting fresh poultices as the old ones become dry and altered in temperature. These two difficulties, however, seriously interfere with the use of poultices in veterinary practice, and often cause them to be set aside in favour of either hot or cold fomentations.

CLYSTERS—GLYSTERS—ENEMA—ENEMATA—INJECTIONS.

Clysters are in frequent use for all domesticated animals. Their composition varies, of course, with the purposes for which they are given; thus, in constipation, they usually consist of soap and water, with sometimes a little oil or turpentine, and occasionally tobacco smoke; in diarrhœa, of starch-gruel, with or without opium, etc. There are no remedies more safe and effectual for keeping the bowels in good order, whether in health or disease; and their diligent use, aided by back-raking, will often safely and effectually fulfil all the purposes of purgative medicine. In tetanus, bronchitis, and other cases in which it is difficult to administer medicine in the usual way, it may often be advantageously given in a clyster, and the dose of the medicine so given may usually be two or three times greater than when administered in the ordinary way. Clysters, when intended to be retained and absorbed, should be limited in quantity. Of the many kinds of apparatus for giving clysters, those in common use are—the old-fashioned bladder tied on a bit of leaden pipe; Reid's patent clyster syringe, which has also the advantage of being available as a stomach-pump; and the common barrel syringe, of which the best kinds are made of copper tinned over, and with a *nozzle* which screws out at pleasure, and can be carried in the interior of the instrument. In the horse the rectum should always be cleared out with the hand before any of these articles are used; and in all animals the part of the apparatus which enters the gut should be smeared with lard or oil, and introduced slowly and carefully.

WEIGHTS AND MEASURES.

There are two systems of weights which the practitioner uses in purchasing and dispensing his medicines—the avoirdupois and the apothecaries'. The former is used by the wholesale druggists and also by retailers when selling quantities amounting to or exceeding an ounce.

The divisions of the avoirdupois weight, and the abbreviations used to denote each division, are as follows:—

27 grains................	= 1 drachm, ʒj.
16 drachms..............	= 1 ounce, ℥j.
16 ounces................	= 1 pound, ℔. j.
14 pounds................	= 1 stone, st. j.
112 pounds..............	= 1 hund. wt., cwt. j.
20 hundred weight....	= 1 ton, ton j.

In the last edition of the Dublin Pharmacopœia this table of weights has been altered in its lower denominations, so as to render it suitable for all pharmaceutical purposes. Throughout England and Scotland, however, apothecaries' weight—a slight modification of the old troy weight—is used in making up prescriptions, and dispensing medicines in quantities less than an ounce. Its several denominations, with their appropriate signs, are as follows:—

20 grains............	= 1 scruple, ℈j.	
3 scruples.........	= 1 drachm, ʒj.....	= 60 grs.
8 drachms.........	= 1 ounce, ℥j......	= 480 grs.
12 ounces..........	= 1 pound, ℔. j...	= 5760 grs.

The apothecaries' measure is generally used for dispensing fluids. It is based on the imperial pint, which is divided into several lower denominations :—

60 minims............	=	1 fluid drachm, f℥j.
8 fluid drachms ...	=	1 fluid ounce, f℥j.
20 fluid ounces......	=	1 pint, O j.
2 pints...............	=	1 quart, Qt. j.
4 quarts.............	=	1 gallon, C. j.

It is often useful to recollect the value by weight of the several denominations of the apothecaries' measure. One minim (♏ j.) weighs rather less than a grain (·91) ; a fluid ounce of water at 60° weighs exactly an ounce avoirdupois ; hence a pint is equal to a pound and a quarter, and a gallon to ten pounds avoirdupois. Every practitioner must, of course, be provided with proper balances of different sizes, legibly marked weights of different denominations, and graduated measures, which, for the sake of cleanliness, should be made of glass or earthenware rather than of metal. It will often save much time, both to himself and his employers, to have the bottles in which he dispenses his medicines graduated to ounces and drachms ; and such bottles may now be purchased at prices very little above those given for the ordinary sorts.

Where standard measures cannot be obtained, the practitioner has often occasion to use some of the ordinary domestic utensils, with the capacity of which he ought therefore to be familiar. Common tumblers contain about ten fluid ounces; tea-cups about five fluid ounces ; wine glasses about two fluid ounces ; table-spoons half a fluid ounce ; dessert-spoons two fluid drachms ; and tea-spoons one fluid drachm. Such measurements, however, are merely approximative. The pint and quart bottles, sub-divisions of the old wine measure now disused, contain respectively 13 fluid ounces and 26½ fluid ounces, and *not*, as their names might indicate, 20 and 40 fluid ounces. Medicines are sometimes measured by the drop, which, however, varies exceedingly with the density of the liquid and other circumstances. A drop of water measures a minim, and weighs a grain.

VETERINARY MEDICINES:

THEIR

ACTIONS AND USES.

VETERINARY MEDICINES.

I SHALL notice the different articles of the veterinary materia medica in alphabetical order according to their English names. I shall, however, arrange the medicinal salts of each metal in the order followed in most works on chemistry.

In treating of each particular medicine I shall endeavour to discuss its more remarkable and important properties in the following order:—Its names, history, and sources—its preparation—its physical and chemical properties—its impurities, and the mode of detecting them—its general action on the various domesticated animals in health and disease—its uses, doses, and most suitable mode of administration or application.

ACETIC ACID.

Acidum aceticum. $C^4 H^3 O^3 + HO$.

The pharmacopœias recognise acetic acid under the following varieties of strength and purity—acetic acid; pyroligneous acid, which is merely an impure acetic acid; and British, French, and distilled vinegars.

Acetic acid is usually prepared by the distillation of vinegar or the decomposition of one of the acetates. The acetates of potash or soda are sometimes used, but that of lead is preferable, as yielding with less trouble a purer acid. The essential parts of the process, as fully detailed in the Ed. Phar., consist in depriving the salt of its water of crystallization, heating it with the proper atomic proportions of sulphuric acid at a carefully regulated temperature, adding a little red oxide of lead to remove any trace of sulphurous acid, and then redistilling.[1] When thus prepared, it is a mobile colourless fluid, with an acetous odour, a pungent taste, a corrosive action upon organised tissues, and a density of 1063–1066. It rises in vapour at about 260°, is combustible, crystallizes at 50°, and is hence known as glacial acetic acid. It reddens litmus, gives white fumes with ammonia, dissolves volatile oils, resins, camphor, and vegetable alkaloids, and unites with bases to form crystallizable and soluble salts, called acetates. These produce a red brown colour with perchloride of iron, are decomposed by sulphuric acid, and evolve acetic ether when heated with equal parts of alcohol and concentrated sulphuric acid. This strong acetic acid consists of one equivalent of water and one of anhydrous acid, which has the composition $C^4\ H^3\ O^3$, and only exists in combination. The preparation usually sold in Scotland as strong acetic acid has the properties of that just described, but is scarcely so strong, containing 11 per cent. less acid. The London and Dublin acids are both much weaker; that of the English College containing 34–37 per cent., and that of the Irish about 50 per cent. of the hydrated acetic acid.

The strength of acetic acid, and the proportion of water which it contains, may be ascertained in two different ways; by the quantity of crystallized carbonate of soda required to neutralize it, and by its density, which in the pure acid should be 1063, and should increase on the addition of 20 per cent. of water. When gradually diluted, it rises first to 1078, and then falls again as more water is added. From this peculiarity acids of two very different strengths may be indicated by the same density. Thus, the density 1063 is that both of glacial acetic acid and of an acid containing equal parts of the glacial acid and water; and so up to 1078, each density may indicate one of two acids differing greatly in strength. It is easy, however, to discover to which of the two acids

[1] I have not thought it necessary to transcribe the details of the process, as no veterinary surgeon requires to manufacture strong acetic acid, which is now made on the large scale, of great purity, and at a very moderate cost.

any particular figure refers, for the addition of a little water raises the density of the stronger, and diminishes that of the weaker acid. When free from sulphuric acid and metallic impurities, acetic acid should be unaffected by solutions of chloride of barium and sulphuretted hydrogen.

Pyroligneous Acid.—When any of the hard woods, as willow, oak, or beech are exposed to destructive distillation in capacious iron vessels, there comes over a dark brown empyreumatic liquid called pyroligneous vinegar. This contains creasote and similar principles, and is much used for curing meat. When its strength and purity are increased by redistillation, it constitutes the pyroligneous acid of the shops—a colourless or pale straw-coloured liquid, with a strong acetous taste, and varying considerably in density and strength. That recognised by the Edinburgh College has the density 1034, and contains 25 per cent. of the hydrated acetic acid above described. ♏ 100 of it should neutralise at least grs. xxv. of crystallized carbonate of soda.

Vinegars.—Vinegar is diluted acetic acid containing further variable proportions of colouring matter, mucilage, alcohol, etherous principles, sulphuric acid, and sulphate of lime. There are two chief processes by which it may be got—by the destructive distillation of wood, as in the manufacture of pyroligneous acid, and the vinegars made from it; and by the oxidation of alcohol, by exposing it to the air, at a somewhat elevated temperature, and in contact with a ferment. Most British and continental vinegars are manufactured in this way from various substances containing alcohol; in this country from weak spirits, malt liquors, or solutions of sugar; in France, by exposing some of the poorer wines in half-filled casks; and in Germany (by what is often termed the quick or improved method of vinegar-making), from diluted alcohol, which is mixed with about one 1000th part of yeast, honey, vinegar, or other fermentescible body, and allowed slowly to trickle over a large surface of wood-shavings, at a temperature of 75° to 80°. After about twenty-four or thirty hours, the alcohol becomes oxidised at the expense of the oxygen of the air, and is thus converted into vinegar. The various changes which occur during this process are somewhat complex, but the ultimate change may be easily understood from the following formula :—

$$\text{Alcohol} + \text{Oxygen} = \text{Acetic acid} + \text{Water}.$$
$$C^4\,H^6\,O^2 + 4\,O = C^4\,H^3\,O^3 + 3\,HO.$$

The British vinegars are colourless, or nearly so, have an acid taste and re-action, and when of good quality, a refreshing acetous odour from the presence of acetic ether. The finest quality of vinegar is the French or Champagne vinegar, distinguished from the British vinegar by its etherial acetous odour, dark colour, and high density, and by its yielding, when treated with ammonia, a purple colour and a purple flaky sediment, which indicate its being made from some of the red wines. Distilled vinegar does not materially differ from the better qualities of French vinegar. It is prepared by distilling French vinegar at a gentle heat, and rejecting the first and last portions that come over. It is colourless, entirely dissipated by heat, of an ethero-spirituous odour, and of the density 1005. Diluted pyroligneous acid is often sold in the shops, generally under the name of wood-vinegar. It consists of one part of pyroligneous acid to three of water, and is very suitable for all veterinary purposes, except for making the spirit of the acetate of ammonia.

Impurities.—The most common adulterations of vinegar are water and sulphuric acid. Water is discoverable by its diminishing the density and the power of neutralising crystallised carbonate of soda. The British vinegars should have the density 1006 to 1019; the French, 1014 to 1022; and the distilled, 1005. ♏ 100 of the last neutralise grs. viij. of carbonate of soda. The addition to vinegar of one 1000th part of sulphuric acid, is allowed by the excise laws, in the belief that it prevents spoiling. But the legal proportion is often greatly exceeded. All the sulphuric acid in four fluid ounces of vinegar should be precipitated by ♏xxx. of solution of nitrate of baryta, of pharmaceutic strength. Copper and lead are sometimes present, and are detected by their precipitating sulphuretted hydrogen.

Actions and Uses.—Acetic acid, when in a state of concentration, is corrosive and irritant; and when diluted, stimulant, diuretic, astringent, and refrigerant.

Its irritant effects are somewhat less energetic than those of the strong mineral acids, but it produces death, with analogous symptoms, causing in dogs much uneasiness, vomiting and abdominal pain, weakness of the hinder extremities, and exhaustion. An ounce of the strong acid was fatal in an hour; a quarter of an ounce of pyroligneous acid in from five to nine hours; and four or five ounces of common vinegar in ten or fifteen hours (Christison on Poisons). Among the larger domesticated animals it is much less active, horses taking from six to twelve ounces of the commercial acid, and cattle doses of three or four pounds, without apparent bad effect (Hertwig). Neither acetic acid nor any of its solutions is much used internally. As stimulants they have been displaced by the mineral acids, and as diuretics their efficacy is very doubtful. Vinegar was once in high repute as an antidote for almost every sort of poisoning; but is now employed only in the case of the alkalies and alkaline carbonates. In the human subject, when taken internally in small quantities it stimulates digestion, but in large amount it retards both digestion and assimilation, and has hence been sometimes foolishly used to reduce corpulency. This it can only do at the sacrifice of health.

When applied externally, strong acetic acid is a powerful corrosive. If rubbed into the skin, it speedily causes redness, and the eruption of large blisters resembling those produced by scalding hot water. From dissolving albumen, fibrine, and gelatine, it is of much value in removing warts and such like excrescences, as well as corns in the human subject. It is applied as an astringent and styptic, and is often useful as a stimulant, and a means of removing scurf in cases of ringworm, mallenders, and sallenders, scab and mange. In these cases, the impure pyroligneous acid is preferable to the purer acetic acid, probably from containing creasote and similar empyreumatic principles. Vinegar in its various forms is used for refrigerant lotions in superficial inflammations and bruises; but for these purposes cold water is nearly as effectual, though it does not look quite so medicinal. When employed for fumigating stables or byres, it probably does more harm than good; for it disguises those noxious effluvia which it neither removes nor destroys, and thus prevents due attention to thorough ventilation, and the use of efficient deodorisers and disinfectants. It dissolves the active principles of many medicines, and enters into the composition of various pharmaceutical compounds, as vinegars of cantharides and colchicum, spirit of Mindererus and oxymel. Oxymel is made by boiling together vinegar f℥xj., and sugar ℥xiv. The antiseptic properties of vinegar recommend it for preserving various sorts of vegetables.

Doses, etc.—Acetic or pyroligneous acids when used internally are given in about the same doses as the common mineral acids, namely, f℥i. to f℥ij. for horses or cattle, and ♏ij. or ♏iij. for dogs.

ACONITE.

Monkshood. Wolfsbane. Aconitum.—Tubers and leaves of *Aconitum Napellus* and *A. ferox.*

Nat. Ord.—Ranunculaceæ. *Sex. Syst.*—Polyandria Trigynia.

Botanists have numbered twenty-two species, and upwards of a hundred varieties of aconite. Some species are inert or nearly so; but others, as the Aconitum ferox, Sinense, and Napellus, are very active. The last of these, the common officinal species, is a doubtful native of Britain, but often cultivated in gardens and shrubberies on account of its flowers. It appears to be equally active whether it be wild or cultivated. Its several varieties are herbaceous plants, with tapering carrot-shaped, black root-stocks, from which, after the first year's growth, are formed one or more oval-shaped tubers; annual stems from two to five feet high; deeply divided, dark green leaves; long-stalked, helmet-shaped, blue or purple flowers, which form a dense spike, and usually appear in June or July; and dry, black, shrivelled seeds, which ripen about the end of August. The root, which is the most active part of the plant, and is consequently most valued, should be taken up after the plant has flowered in autumn, or before the new stem rises in spring, cut into small pieces, and dried at a low temperature. The leaves are less active than the root, but more so than the flowers, fruit, or stem, and should be gathered for use before the flowering season is over. Any part of an active or poisonous aconite, when slowly chewed, produces a peculiar acridity, numbness, and tingling of the lips and tongue, unaccompanied by any irritation or inflammation. This, besides being a good test of aconite, also affords a very easy and accurate method of judging of the activity of any specimen of the drug, for it is most observable in those varieties and parts of the plant which are most potent as medicines and poisons. When powdered, the root and leaves have a dirty grey colour, and a strong earthy odour. Their active principles are readily soluble in alcohol, but sparingly so in water, and hence watery preparations are not commendable. Aconite owes its activity as a poison, and its value as a medicine, to an alkaloid termed *aconita*, a light yellow, transparent, vitreous, acrid, bitter substance, crystallisable with some difficulty, insoluble in water, but soluble in alcohol, decomposable by heat, and capable of producing, when placed in the mouth, the same peculiar sensations as the crude drug. It is very expensive, costing, when pure, 3s. 6d. per grain.

Actions and Uses.—Aconite is a most active poison, paralysing the nervous functions, and acting as a powerful general sedative. It is used medicinally as a sedative, anti-spasmodic, and anodyne. It proves poisonous to all animals, from infusory animalcules and earth-worms to man himself. Absorption into the blood-vessels usually appears essential to the development of its effects, which primarily and chiefly consist in depression of the functions of all parts of the nervous system, except the brain proper. It is altogether devoid of irritant properties. The peculiar impression which it causes when chewed, or otherwise brought into contact with mucous or cutaneous surfaces, is purely nervous, and accompanied by no vascular excitement or visible alteration of structure; whilst the vomiting which it occasionally produces affords evidence not of irritation, but of functional derangement of the vagus nerve. Its poisonous action on veterinary patients is well marked. Viborg mentions that a horse, after receiving eight ounces of the root and lower leaves of the aconitum Napellus, became very uneasy, breathed slowly and with difficulty, attempted to vomit, exhibited a depressed, irregular, and intermittent pulse, and looked round at his flanks as if suffering pain; but that he gradually recovered in about six hours. Next day he got three quarters of a pound of aconite, which induced similar symptoms, and death in about twelve hours. (Hertwig.) Similar symptoms have been observed in some experiments recently made at the Edinburgh Veterinary College, and carefully recorded by Mr Barlow :—

A black mare, 15½ hands high, previously used for slow work, and in good health, got at 12.40 P.M. (27th September 1852) one fluid drachm of Fleming's tincture of aconite. At 1 she was nauseated, had eructations of frothy mucus, with attempts to vomit, which increased till 1.30, when she went down. The pulse, which was 35 before the administration of the poison, was now 60, and very weak. She continued down till 7 P.M., when she was destroyed in consequence of being unable to stand.

On 24th September 1852, an aged chestnut cab horse, 16 hands high, and useless from a bad quittor, was tied up by the head for ten minutes, to ensure perfect quietude. The pulse was then found to be 56, and the respirations 12. The animal had a good appetite, and regular evacuations. At 10 o'clock he got ninety minims of Fleming's tincture of aconite in a linseed-meal ball, the head being still kept tied up for fifteen minutes. In half an hour he fed greedily on potatoes and beans, but no change was observable, and at 1 P.M. he got ♏L. of the same tincture in f℥ iv. of water. At 1.15 he appeared to be making continual efforts to swallow something, his mouth was closed; and after such attempts at swallowing, air and fluid were regurgitated up the gullet, causing a rattling noise, as of air-bubbles mixed with water. At 1.20 the pulse was 50; symptoms of actual nausea appeared; the muscles on the side of the neck and throat were contracted; the muzzle brought near to the breast; the lips retracted; and the mouth slightly opened. Fits of retching came on every two minutes, and increased in violence during the next ten or fifteen minutes. 1.30—During each paroxysm of retching, the mouth was opened, the lips widely retracted, and four or five ounces of frothy mucus discharged on the ground. The pulse had fallen to 40, and become weak. On account of the retching, the respirations could not be counted. Copious perspiration broke out all over the body, and increasing distress was shown in the quivering surface, and pallid mucous membrane of the mouth, nose and eyes. 2 P.M.—

Pulse 38, and weak; the respirations not easily counted, but probably about 9; in other respects no change. The animal passed fæces and urine freely; and shortly after getting a pint of cold water, lay down somewhat relieved, with the retching scarcely so frequent. At 2.30, the pulse was weaker than ever; the breathing irregular, interrupted and *sighing;* and the animal unable to rise. The labial and nasal muscles were contracted, causing retraction of the lips, and disclosing the gums blanched, and the teeth covered with frothy mucus. Two bottles of strong ale were given with half an ounce of spirit of ammonia. At 3 P.M., the pulse was 35, and still weaker than before; the respiration was somewhat accelerated, probably owing to the animal's being down; the perspiration continued to stream from every part; and the retching, though somewhat subsided, still came on about every ten minutes. The animal remained down without much change until about 6, when the nausea was somewhat diminished, but the pulse so weak as to be scarcely perceptible. He was raised with difficulty, and stood blowing much for fifteen minutes. At 7 there was little change; the pulse remained imperceptible; the respirations about 20; and the patient unable to eat or drink. He was left with the expectation of finding him dead next morning; but at 7 A.M. (25th), he was up and eating. His pulse was 65; his respirations 10; and his appearance very haggard and reduced. October 1st.—Since last date he has never regained his former look or appetite; for two days has been unable to rise or stand; and has become much wasted. He was destroyed by six drachms of prussic acid; but, on post mortem examination, every part except the lungs seemed quite healthy. These organs, more especially the right one, were extensively studded with patches of extravasated blood about the size of walnuts, which in those parts connected with the pulmonary tissue were more or less softened, and emitted an odour characteristic of heated decomposed blood. The rusty fluid produced from the softening had in various places passed into the bronchii, imparting to their frothy mucous a brown colour.

Among carnivorous animals a violent and speedy effect is readily produced by aconite, as is well shown in the two following experiments made at the Veterinary College in October 1852. A cat of average size got ♏vii. of Fleming's tincture of aconite. In two minutes severe retching came on, and in five minutes painful vomiting and involuntary muscular contractions of a most active kind, with perverted action of the voluntary muscles, causing the animal to leap up the wall and turn somersaults backwards. The vomiting and muscular action continued till within two or three minutes of death, which took place twenty minutes after the administration of the poison. No morbid or peculiar post mortem appearances were observable.

An ordinary sized Scotch terrier got ʒss. of Fleming's tincture.

In five minutes painful and active vomiting came on, which must have effectually emptied the stomach. The retching and vomiting continued, however, for half-an-hour, when the animal was so exhaused and paralysed in its hinder extremities as to be unable to walk except by supporting itself on its fore limbs, and dragging the hind ones after it. It gradually recovered, however, in about two hours. In some other cases a drachm has destroyed dogs with as much rapidity as an equal quantity of prussic acid. Among ruminating animals the action of aconite when introduced into the stomach is less prompt and powerful than in other animals, and Dr Fleming found that the activity of aconite was sensibly diminished by digesting it with the gastric secretions either of rabbits or calves.[1] When, however, it is injected into the veins, or placed underneath the celular tissue in these animals, it develops its poisonous effects as readily as in other animals, and with the same marked depression of the action of the heart.

According to the dose in which it is given, aconite appears to destroy life in one of these three ways,—1st. In very large amount it sometimes kills by communicating a sudden shock, possibly somewhat in the same manner as a blow on the stomach, or a flash of lightning; 2d. It paralyses the muscles of respiration; and 3d. It paralyses the action of the heart. In most cases death results from the concurrence of the two latter effects.

In poisoning by aconite, emetics or the stomach pump must be promptly used to get rid of any of the poison that may still remain unabsorbed. For a similar reason cathartics are also useful. The only chemical antidote of any value is tannic acid, which owes its efficacy to its forming an insoluble compound with the aconita; but to be of any service it must be used promptly. Endeavours must be made to ward off the mortally sedative effects of the drug by the use of diffusible stimulants; and it may be recollected that congestion of the lungs, which is

[1] See Dr Fleming's admirable monograph on the physiological and medicinal properties of *Aconitum Napellus*.

often the immediate cause of death, may be much relieved by bleeding from the jugular.

Aconite is a most prompt and effectual sedative and antiphlogistic in febrile attacks and acute local inflammations. In these cases it speedily moderates the action of the heart, and hence reduces the quantity of arterial blood which passes in a given time to any part. It thus acts much in the same way as blood-letting, but, besides being safer and more manageable, it is less apt to induce such extensive and continued depression of the vital energies. Aconite somewhat resembles opium in its sedative effects, and in its relieving pain and spasm; but acts less prominently on the brain, and more decidedly on the sympathetic or organic system of nerves; while its sedative action is not preceded by any obvious excitation. Though somewhat like digitalis, it differs from it in being anodyne and antispasmodic, whilst its sedative action is induced more speedily and certainly, and without any risk of cumulative effect.

Mr Balfour, V.S., Kirkcaldy, has employed aconite for upwards of three years, and informs me that he finds it the most certain and successful sedative he has ever used. He has found it most useful in pneumonia, pleurisy, and bronchitis, both in horses and cattle, in many cases of influenza, and also in weed. It has been successfully employed at the Edinburgh Veterinary College, by Mr Balfour, V.S., and by many other private practitioners, both in England and Scotland, for the cure of pleuro-pneumonia among cattle. In such cases, especially when of an acutely inflammatory type, it is far more effectual than tartar emetic, calomel and opium, or any other sedative; and, when given sufficiently often, is quite equal to blood-letting in its power of reducing the pulse, relieving the respiration, and removing fever; while it is greatly preferable to it inasmuch as it reduces the inflammation without leaving any weakness or tendency to typhoid fever. In rheumatism it usually relieves both the constitutional fever and the local inflammation, and is believed to prevent the malady from extending to the heart and its membranes. Moiroud and others speak highly of its utility in obstinate dropsies, and Stahl of its value in the removal of worms; but its efficacy in such cases is doubtful. From its action on the superficial sensory nerves, it is often useful as a local anodyne in neuralgic or rheumatic affections, painful wounds, or swellings of a chronic and non-inflammatory kind; and in such cases not only allays pain like opium, but also often removes its cause. Its uses, both as an internal and an external remedy, are capable of being greatly extended.

Doses, etc.—Aconite is not usually employed in the crude state either of root or leaves. The extract, unless very carefully prepared from an alcoholic solution, or from the expressed juice, is apt to be of defective or irregular strength. The tincture is the simplest and best preparation. Professor Fleming directs it to be thus prepared :—

"Take of root of Aconitum Napellus, carefully dried and finely powdered, sixteen ounces troy; rectified spirit, sixteen fluid ounces; macerate for four days; then pack into a percolator, add rectified spirit until twenty-four ounces of tincture are obtained. It is beautifully transparent, of the colour of sherry wine, and the taste is slightly bitter."

The dose of the tincture for horses is about ♏x.; for cattle, from ♏x. to ♏xx.; and for dogs, from ♏j to ♏ij. It should be given in diluted spirit, at least every second hour.

Aconita.—The alkaloid of aconite is one of the most active of poisons. Mr Headland mentions, in his "Prize Essay on the Action of Medicines," that $\frac{1}{300}$th of a grain in solution in water, suffices to destroy a mouse; $\frac{1}{100}$th of a grain kills a small bird after a few minutes, and $\frac{1}{50}$th almost instantaneously; $\frac{1}{20}$th or $\frac{1}{10}$th kills cats, the latter quantity in twenty minutes or half an hour; and $\frac{1}{2}$ of a grain given to a shepherd's dog, weighing 20 lbs., began to operate in three or four minutes, and proved fatal in sixty-five minutes. The symptoms and post-mortem appearances are the same as in poisoning with the crude drug, the extract, or the tincture. The alkaloid has been sometimes used in human medicine as an external application, in the forms of alcoholic solutions or of ointment.

ALCOHOL.

Spirit of Wine. $C^4\,H^5\,O + HO$.

Alcohol is admitted into the pharmacopœias in three distinct forms—as absolute alcohol, rectified spirit, and proof spirit. These are obtained either directly or indirectly from the fermentation of saccharine solutions; in this country from infusions of malt, in most parts of the Continent from the juice of the grape, in Germany from potatoes, and in Jamaica, and other rum-producing countries, from molasses. In these and all other processes for the preparation of alcohol, saccharine matter is dissolved, and exposed to the action of a ferment or albuminous body in a state of disturbance, which breaks it up into alcohol, carbonic acid, and water. The decomposition may be better understood from the following formulæ:—

$$\begin{array}{l} \text{1 Equiv. of Grape Sugar} \\ C^{12}\,H^{14}\,O^{14} = \end{array} \left\{ \begin{array}{l} 2\,(C^4\,H^6\,O^2)\ \text{Alcohol.} \\ 4\,(CO^2)\ \text{Carbonic acid.} \\ 2\,(HO)\ \text{Water.} \end{array} \right.$$

From this it will be obvious that pure alcohol has the composition $C^4\,H^6\,O^2$, but as it is believed to be the hydrated oxide of a radicle ($C^4\,H^5$) called ethyle, it is more commonly represented as $C^4\,H^5\,O + HO$.

When a fermented saccharine solution is exposed to a high temperature, the alcohol distils over, mixed, however, with water and various impurities; and if the distillation be several times repeated, the fluid will reach the density 825, which, according to the British excise law, constitutes alcohol or pure spirit. It is not, however, *absolute* alcohol, but still contains about 7 per cent. of water, which, though inseparable by any amount of distillation, may be removed by various hygroscopic or water-absorbing bodies. Dried chloride of calcium is recommended by the London and Dublin Colleges, but this only reduces the density to 815, still leaving 4 per cent. of water. The last traces of water may, however, be readily removed, and *absolute alcohol*, of the density 794·6, obtained, by allowing strong distilled spirit to remain for a short time in contact with quicklime. (Ed. Phar.) Absolute alcohol is a mobile, colourless fluid, with a spirituous odour, an intensely hot fiery taste, and a density of 794·6. It is very volatile, boils at about 170°, and burns without producing smoke. It has never been frozen. It has a great affinity for water, absorbing it readily from the atmosphere, and mixing with it in all proportions. When oxidised, it forms acetic acid; and when decomposed by acids, produces ethers. It dissolves those salts most readily which are most soluble in water, and haloid better than amphide salts. It is also a good solvent for volatile oils, resins, vegetable acids, and bases.

Rectified Spirit is the generic term applied to alcohol varying in density from 835 to 840, and containing from 10 to 12 per cent. of water. Its properties are very similar to those of absolute alcohol. It has, however, less pungency and volatility, and a higher boiling point. It is a better solvent for fixed oils and resins, but a worse for most other organic substances.

Proof Spirit is diluted alcohol, having the density 912, according to the Edinburgh College, and 920 according to the London and Dublin Colleges, and the excise laws. It is very conveniently prepared, as directed by the Edinburgh College, by mixing one measure of water and two of commercial rectified spirit; and when thus made, is freer from impurity than the weak, imperfectly rectified spirit of the shops.

In order to know the strength and consequent value of commercial spirits, it is necessary to understand the scale and terms used under the excise laws. These regard as the purest and strongest alcohol that made by distillation alone, and hence only reaching the density 825. They fix proof spirit at 920; and, starting with this as zero, consider all stronger spirit as *over* proof, and all weaker as *under* proof; estimating the exact strength of any specimen over proof by the number of volumes of water required to reduce every hundred volumes of it to proof; and of any specimen under proof, by the number of volumes of excise alcohol required to raise every hundred volumes of it to proof. Thus the best whisky or brandy is about eleven over proof; or, in other words, of such strength that eleven volumes of water would require to be added to every hundred of it, to reduce it to the strength and density of excise proof spirit. Again, rectified spirit, with the density 840, is fifty-six over proof—

that is, every hundred volumes of it must be diluted with fifty-six of water, to bring it to the level of proof spirit. On the other hand, spirit ten under proof, to be raised to proof, would require that every hundred volumes should be mixed with ten volumes of alcohol with the density 825.

The following alcoholic fluids so much employed both dietetically and medicinally for man, are occasionally also prescribed for the lower animals :— *Wine*, the fermented juice of the grape, containing from 10 to 25 volumes in the hundred of excise alcohol (density 825), and owing its peculiar bouquet to œnanthic ether ; *brandy*, prepared by the distillation of the weaker wines, and containing about 53 per cent. of excise alcohol ; *rum*, a fluid of about the same strength, made by the distillation of a fermented solution of molasses ; *whisky*, of similar strength, and obtained by distilling a thoroughly fermented solution of malt ; and *Hollands*, *Geneva*, or *gin*, a little weaker than these, and prepared from fermented malt, with a small quantity of juniper berries. *Ales* and *porter* are also useful stimulants in almost every day use. They are made by infusing malt in water at about 180° ; allowing it to stand for a few hours until the starch has been in great part converted into dextrine and sugar ; boiling the solution with the requisite quantity of hops ; and adding yeast to cause fermentation, which, however, must be carefully prevented from going too far. The dark colour of porter depends on a part of the malt used in its manufacture being roasted. Porter and ales are about the same strength, containing between 4 and 7 per cent. of excise alcohol (density 825).

Impurities.—Water is one of the most common impurities to which alcoholic fluids are liable, and is discoverable by its increasing the density of the spirit, which may be ascertained by testing it either with a hydrometer, or with marked beads. Commercial spirits, when prepared from malt, are always contaminated by an ill-flavoured, pungent volatile oil, called fusel or grain oil, which is apt to spoil the finer tinctures and liqueurs, and is discoverable from its causing the spirit to be blackened by sulphuric acid, or exposure to the action of nitrate of silver and light. To remove this impurity the manufacturer mixes the spirit with water previous to each distillation, or digests it with animal charcoal; but neither of these processes is very effectual, and distillation off burnt alum, or chloride of calcium, or the addition of nitrate of silver, though greatly better, are not available on the large scale.

Actions and Uses.—Alcohol acts locally as an irritant, sedative, astringent, and antiseptic; and generally as a stimulant, narcotic, and diuretic.

When a few drops of strong spirit are put into the eye, or a small quantity introduced into the stomach of a dog, or other small animal, topical irritation, with increased vascularity and redness, is first observed; but this soon gives place to diminished vascularity and sensibility, usually corresponding with the previous excitation in continuance and degree. Alcohol has thus a primary irritant, and a secondary sedative effect. Its astringent and antiseptic actions depend on its coagulating albumen, and also, in the case of strong spirit, on its affinity for water. When given internally, it often produces some of the topical effects just noticed, but speedily becomes absorbed, and is detectible in the blood, the soft solids, and various of the secretions. It appears to act directly on the nerves and nervous centres, and in most animals on those parts especially which lie within the cranium. As to its constitutional effects, it induces, first, greatly increased action, and then after a variable time, deranged and depressed action. The relative amount and continuance of these two opposite effects differ materially with the dose and state of concentration of the alcohol. In dogs, very large quantities of strong spirit have sometimes produced rapid depression, coma, and death, within a few minutes, without any appreciable excitement; and several cases of this kind occurring in man are recorded by Professor Christison in his work on Poisons. Hertwig gave an old but sound horse eight ounces of alcohol (density about 825). He became much excited and uneasy, pranced, staggered, and after about two minutes fell, struck out vehemently with his feet, rolled his eyes, the pupils being at first contracted and latterly expanded, gradually became insensible, and died in about ten minutes. The pulse was little altered, and the heart continued to beat for ten minutes after death.

Between four and six ounces produced the same symptoms, but did not prove fatal. From one to two ounces destroyed dogs in periods varying between a quarter and half an hour, with similar symptoms, and great inclination to vomit. From one to two drachms induced in dogs reeling and stupor, which continued for about half an hour. Cattle and sheep, and indeed all ruminants, are less susceptible of its influence than dogs or even horses, and Hertwig mentions that when it is given in the form of brandy to sheep and goats, they soon become very fond of it, taking from six to ten ounces at a time, and gradually becoming less easily affected by it. Alcohol when injected into the veins or serous cavities causes speedy death, accompanied by the same symptoms as attend its administration by the mouth. When a large dose of alcohol speedily extinguishes life, the brain, lungs, and liver are found, on post mortem examination, to be congested with dark grumous blood, and an alcoholic odour is exhaled from the bowels and serous cavities; while, if life has been prolonged for some time after the exhibition of the poison, the stomach and alimentary canal are much reddened, and sometimes, it is said, considerably thickened.

Alcoholic fluids are advantageously employed where nervous power is defective, the surface heat low, and the pulse slow and soft, or quick and small, owing to irritability. In hoven, tympanitis, stomach staggers and colic, alcoholic stimulants, in the form of ales or whisky, though often used empirically, are nevertheless very convenient, safe, and effectual remedies. In simple congestion of the lungs, caused by over-exertion, they are frequently useful in aiding the depressed nervous power to restore the lost balance of the circulation; whilst in debilitating diseases, and in the later stages of inflammatory complaints, as bronchitis, influenza, and even enteritis, they are also of much service in rousing the powers of life, and inducing that healthy re-action which is alone effectual in overcoming the consequences of previous disease. In all these cases, it is of importance to repeat the medicine very frequently, so as to keep up the advantage gained by each single dose, and prevent that secondary depression which would otherwise ensue. Spirituous fluids, in their removal from the body by the kidneys and skin, stimulate these secreting organs, causing diuresis, and also, though to a less extent, diaphoresis. In veterinary practice, however, they are not given expressly to induce either of these effects. When taken in moderate quantities, they appear to become oxidised into carbonic acid and water, and on this account are sometimes useful in the human subject as calefacient articles of diet.

When alcohol, in a state of concentration, is applied to the more delicate parts of the skin, it acts as a rubefacient, but is seldom used for that purpose among the lower animals. In a more diluted form, it is used as a refrigerant, and for this purpose is sometimes mixed with an equal quantity of vinegar and muriate of ammonia, in the proportion of an ounce of the salt to a pint of the mixed fluids. When made into a mucilaginous consistence with albumen, it is used in the human subject to prevent excoriation of parts exposed to pressure. It is much used in pharmacy, especially for the preparation of tinctures and extracts.

Doses, etc.—The dose of rectified spirit for horses is fʒi., or f℥ij.; for cattle, from f℥iij. to f℥vi.; and for dogs, about fʒij. The doses of whisky, brandy, or ales must be left to the judgment of the practitioner; but these and all other spirituous fluids should be given frequently at short intervals, as every one or two hours.

ALOES.

ALOE. Inspissated juice or extract of various species of *Aloe*.

Nat. Ord.—Liliaceæ. *Sex. Syst.*—Hexandria Monogynia.

The several species of *aloë*, which yield the various sorts of commercial aloes, are succulent plants, having short woody stems, strong, thick, fleshy, amplexicaul leaves, with sharp serrated edges, and a strong spine projecting at the apex. The bitter purgative juice is contained in cells lying immediately underneath the surface of the epidermis of the leaf, the rest of which is filled with a bland colourless sap. The mode of obtaining the juice differs somewhat in the different countries whence aloes is procured. It is sometimes allowed to exude spontaneously from incisions made in the leaf, or its flow is hastened by the application of a moderate heat. The aloes thus got is of the finest quality. A somewhat inferior sort is procured by exposing the leaves to pressure, which causes a mixture of the cathartic juice with the mucilaginous sap of the mass of the leaf; and a still more inferior sort is prepared from leaves that have already yielded most of their purgative juice, by cutting them into small pieces, boiling them with water, and evaporating the decoction.

Varieties.—The most important varieties of aloes met with in commerce and used in medicine, are Barbadoes, East Indian, Socotrine, Cape, and Caballine. Each of these varies in quality, frequently giving rise to several sub-varieties. In the following paragraphs, I shall describe the botanical source, mode of preparation, and more prominent properties of each of the chief varieties of aloes, briefly noticing their more important sub-varieties.

Barbadoes Aloes (*aloë Barbadensis*) is the variety of aloes most extensively used in veterinary practice. It is believed to be the produce chiefly of the *aloë vulgaris*, which has a short, cylindrical, woody stem ; sword-shaped leaves, with hard, reddish spines, a tough and leathery cuticle, and a light brown-coloured parenchyma ; and tubular yellow flowers. The preparation of Barbadoes aloes is not confined, as the name might indicate, to the Island of Barbadoes, but is also carried on in Jamaica and most of the West Indian Islands. It is obtained from the leaves occasionally by cutting them in pieces, and allowing the juice to drain into tubs ; but more commonly by placing the chopped leaves in bags or baskets, and immersing them for a few (ten) minutes in boiling water, which, when fully charged by the repeated immersions of fresh portions of the leaves, is set aside to cool. The sediment is carefully kept back, and the clear fluid poured off, and cautiously evaporated to the required consistence, which is ascertained by taking out a few drops, and observing if they become brittle and concrete on cooling. When sufficiently concentrated, the juice is poured into gourd shells, and the opening closed by a bit of shell let in, and secured in its place by a piece of coarse cloth nailed over it. The gourds, when filled, usually weigh from 60 to 70 lbs., and fully 2000 of these are annually exported from Barbadoes alone. But aloes is also largely exported from that Island in boxes and packages, holding generally about 56 lbs. each, and of these the annual exportation has sometimes been above 2000.

Barbadoes aloes has a dark or liver brown colour, a brown, opaque, earthy fracture ; a disagreeable, bitter, persistent taste ; and a strong and disagreeable odour, especially when breathed upon—an odour generally likened to that of the human axilla. It is tough, gummy, and difficult to pulverise ; its powder is olive green, and darker than that of any of the other commercial varieties. The dark colour, dulness, and opacity of Barbadoes aloes are generally stated to depend upon the presence of water, but may also be owing to the presence and condition of the aloin. When dissolved in weak spirits it leaves an abundant floculent residue.

East Indian Aloes (also called *hepatic* and *Bombay* aloes) is neither grown nor extracted in the country from which it derives its name, but is brought from Arabia, and the coasts of the Red Sea and Persian Gulf, to Bombay and other Indian ports, and thence exported to Europe.

It is supposed to be obtained from the *aloe socotrina*, the same species as yields socotrine aloes—a plant having a straight woody stem about a foot and a half high ; green ensiform leaves, incurvated at the apex, with numerous small white marginal serratures, and a parenchyma abounding with a bright brown yellow juice. Its flowers are scarlet at the base, and become green towards the top. The manner of extracting and purifying it is not well known. It comes to the London market in tinned boxes holding 56 lbs., or in skins, of which several are packed into casks or firkins.

The quality and appearance of East Indian aloes are very variable. It is usually of a brown red colour, dull, and rather opaque, but in small fragments red, sparkling, and tolerably transparent. Its powder is brownish yellow ; its odour less disagreeable than that of either Barbadoes or Cape aloes ; and its taste, like that of all the varieties, bitter and nauseous. Spirit of the density of Sherry does not fully dissolve it, but leaves a fleecy residue. Aloes native to India are considered usually of inferior quality, and are rarely exported. A variety termed *Mocha aloes* is occasionally met with in drug warehouses, is very variable and irregular in appearance and quality, and is considered an inferior sort of East Indian aloes.

Socotrine Aloes is of very fine quality, and is brought in quantities of a few tons annually from the islands of Socotra and Madagascar. It is believed to be the produce of the *aloe socotrina* (which is also thought to yield most of the East Indian aloes). It is supposed to be prepared by allowing the juice of the leaves to exude spontaneously, and then evaporating it by exposure to the heat of the sun. But Professor Christison and others are of opinion that true Socotrine aloes is very rarely met with in the shops, and that by far the greater proportion of what is sold as such is not genuine, being either selected portions of East Indian aloes, or a purified extract of that variety.

According to Christison and Pereira, Socotrine aloes occurs in reddish brown pieces, of variable size, and of a garnet red translucency when thin. It has a fracture generally smooth, glassy, and conchoidal, but occasionally rough and resembling that of a tear of myrrh ; and a fragrant agreeable odour, which is increased if the specimen be breathed upon or heated. It is brittle and easily reduced to powder, which is of a golden yellow colour, and almost entirely soluble in spirit of the density 950 (the strength of Sherry). It is distinguished from the East Indian aloes by its redder colour, and greater lustre, transparency, and solubility, and is believed by Pereira to differ from it on account of its being prepared by the aid of heat—an inference which he considers substantiated by the fact that East Indian aloes, when purified by heating and melting, acquires most of the characters of the Socotrine variety.

The finer varieties of Socotrine aloes are sometimes called *aloes humida*, or *clear aloes*, which appear also to have been the names applied to a variety now extinct.

Pereira lately described[1] a soft semi-fluid sort of Socotrine aloes recently imported in considerable quantity. He considered it to be the raw or unboiled juice of the plant, and proposed to call it Socotrine aloe juice. It is of the consistence of thin honey, of a deep orange colour, has the strong fragrant odour of Socotrine aloes, and deposits on standing a small quantity of minute prismatic crystals identical with the aloin obtained by Messrs Smith from Barbadoes aloes.

Cape Aloes (*Aloë Capensis*) is brought from the Cape of Good Hope, and is chiefly got from the *aloë spicata*, which has a stem three or four feet high; long leaves, broad at the base, and gradually narrowing towards the point, marked with white spots, and containing a colourless sap; and campanulate and white flowers arranged on a tall spike. The extraction of the juice, as described by Mr Lyell, in Christison's Dispensatory, begins during September and October. The leaves, cut from the plant close to the stalk, are placed in piles, with the cut ends inwards, on sheep-skins or ox-hides spread in holes dug in the ground. The juice slowly drains out, is evaporated in large cauldrons, and exported either in chests or skins, the latter generally containing the better qualities. It is sold at the Cape at from 2¼d. to 3½d. per lb.

Cape aloes is often of very inferior quality, being black, opaque, and vesicular in appearance, and of little activity. Those who have seen its preparation, are of opinion that its low quality is not owing to the species cultivated, to the climate, or other natural causes, but to carelessness in the extraction and evaporation of the juice, and especially to the commencement of operations before the termination of the wet season. But the

[1] Pharmaceutical Journal. April 1852.

better qualities of this variety are little inferior either to East Indian or Barbadoes aloes. They have a dark-brown or olive-green resinous appearance, a compact structure, a vitrous dark-green fracture, and a strong and rather disagreeable odour. They are very brittle, and easily reduced to a powder of a gamboge-yellow colour.

Caballine or *Horse Aloes* is inferior to all the varieties previously noticed, and is now deservedly discarded from veterinary practice. It generally consists of the residue or sediment left from the purification of the more valuable sorts. It varies considerably in colour, opacity, and general appearance, but is black, vesicular, and bituminous, and without the compact structure of the better sorts. It has a strong and disagreeably fetid odour, and always contains a quantity of such impurities as straw, bark, stones, and sand.

A knowledge of the more important distinctive characters of the chief varieties of aloes is best obtained by examination of actual specimens, but reference to the following tabular arrangement may occasionally assist the memory :—

	Barbadoes.	East Indian.	Socotrine.	Cape.
Colour, ...	Liver brown.	Dark liver brown.	Garnet red.	Dark brown, approaching to black.
Recent Fracture, . .	Granular, light liver brown.	Smooth, dark red.	Smooth and conchoidal, occasionally rough.	Shining olive green.
Lustre, ...	Dull and earthy, and quite lustreless and opaque, even in small fragments.	Waxy. In small fragments slightly translucent.	Full resinous. In small fragments ruby coloured, and translucent.	Vitreous. In small fragments yellowish brown, and translucent.
Odour, ...	Strong, and very disagreeable.	Agreeable.	Fragrant.	Strong, and disagreeable.
Solubility in alcohol of the strength of Sherry,	Leaves a very copious residue.	Leaves a considerable residue.	Almost entirely soluble.	Leaves a very copious residue.
Powder, ...	Dull olive yellow.	Yellow, with a red tint.	Golden yellow.	Bright yellow, like gamboge.
Produced by . . .	Aloë vulgaris.	Aloë socotrina.	Aloë socotrina.	Aloë spicata, and probably also other varieties.

Properties.—Aloes, then, is the inspissated concrete juice of the leaves of certain species of *aloë*. In mass it is a solid resinous-looking substance, and is generally rather brittle. Its external surface is duller and darker than a freshly made fracture. It has an intensely bitter and persistent taste, and a strong and more or less disagreeable odour, which is always much increased when the specimen is breathed on or heated. When held in the hand for some minutes, it softens and becomes adhesive. At a low red heat, it becomes partly fused, froths up, chars, and burns. It is almost entirely soluble in boiling water, which, however, deposits, as it cools, a brown substance varying in quantity with the variety of the aloes. Most specimens are entirely soluble in proof spirit, but in weaker solutions of spirit the degree of solubility varies much with the kind and quality of the specimen. The colour of both the watery and alcoholic solutions also varies somewhat in the several commercial varieties; in general, the solutions of Cape aloes have the lightest colour, and those of Barbadoes the darkest. The watery solution reddens litmus, owing to the presence either of gallic or aloesic acid. It is deepened in colour by alkalies, yields an olive-brown coloration with sesquichloride of iron, and a yellow precipitate with acetate of lead. To ensure these reactions, the solutions must be cold. Many eminent chemists have analysed aloes, but the results they have obtained are by no means uniform, and the subject still stands in great need of fuller and more accurate investigations. I subjoin, as the best analysis I can find, one of so-called Socotrine aloes, made in 1846 by M. Edmond Robiquet, and quoted by Professor Christison in his Dispensatory:—

Pure aloes, aloesin (impure aloin),	85.
Ulmate of potash,	2.
Sulphate of lime, with traces of other salts,	2.
Gallic acid (aloesic acid, Pereira),	0.25
Albumen,	8.
Loss,	2.75
	100.00

Aloesin, the bitter saponaceous, resinous, or extractive principle of aloes, may be readily obtained by evaporating a watery solution of any of the varieties of aloes. It is brown, very bitter, and more soluble in water than spirit. Its properties undergo considerable alteration, and its purgative action is much impaired by exposure to high temperatures. It consists of a recently discovered principle called aloin, with about thirty per cent. of resin (Royle), and probably owes its medicinal properties to both these bodies. A brief notice of aloin will be found at the end of the article.

Impurities.—The adulteration of aloes is chiefly confined to the substitution of one variety for another, or to the mixture of an inferior variety with one of more value. Such frauds may generally be easily detected by a knowledge of the characters of the different varieties as above given, especially their colour, lustre, odour, and solubility. The admixture of stones, earth, straw, and the like, must be detected by close inspection.

Actions and Uses.—Aloes is cathartic and tonic; the former action being developed when it is given in considerable doses, the latter when it is given in repeated small doses, insufficient sensibly to increase the action of the bowels.

When aloes in the solid form is given by the mouth, it is probably acted on by the bile and pancreatic fluids, emulsified, saponified, and then in great part absorbed. It has not, however, as yet been detected in the blood, but its disappearance from the part to which it is applied, and its frequently acting on the kidneys, are certain evidences of its entering the circulation. As, however, it cannot, when in any considerable quantity, remain there without harm, it must be excreted, and being generally in too large amount to be easily separable by the kidneys, and being insoluble in air, and hence not removeable by the skin, no other channel of elimination is open to it except the bowels. It is accordingly absorbed into the glandular apparatus covering the intestinal mucous membrane, induces there a copious secretion of fluid, with which it is poured into the canal, and especially, it is believed, into its more posterior parts. The increased peristaltic motion so obvious during the operation of aloes, and which so much enhances its purgative effect, is a reflex action depending on the irritation excited during the solution and absorption, and subsequent excretion, of the drug. The augmented secretions render the feces fluid, whilst the increased peristaltic motion accelerates their discharge.

As compared with many other cathartics, aloes is tardy in its action, and apt to be uncertain, unless when the bowels are in a tolerably regular and normal state. In ordinary circumstances, however, it is a safe and sure purgative for horses. Its effects, except within certain comparatively small limits, do not increase in proportion to the dose; and, unlike most other purgatives, it is not in large doses an irritant poison. It does not, except in very large doses, render the dejections so fluid as saline purgatives, but appears to accelerate the peristaltic motion in a greater degree. Aloes is generally thought to have a special effect in increasing the secretion of bile; but this has never been very satisfactorily established; indeed, though it usually relieves those symptoms which depend on defective action of the liver, bile has been sought for in vain in the feces of animals purged by aloes. It is said to produce evacuations which possess a peculiar disagreeable odour. (Hertwig.) The cathartic action of aloes, like that of all true purgatives, is produced with nearly equal facility by whatever channel it finds access to the blood. It may be produced by placing the aloes in sufficient quantity in the cellular tissue, applying it to any mucous membrane or other absorbing surface, or injecting it in solution into the veins. Six drachms of Barbadoes aloes, dissolved in twenty-four ounces of water, and injected at short intervals into the jugular vein of a horse, caused nausea, frequent straining and efforts to dung, colic which, however, was only of short duration, and after twelve hours, more or less catharsis. Sometimes, when injected into the veins, it acts on the kidneys rather than the bowels. Thus Moiroud[1] injected four drachms, dissolved in diluted alcohol, into the veins of a horse, and next day eight drachms, dissolved in a similar manner; but, instead of any effect on the bowels, he observed only the evacuation of a large quantity of urine.

[1] Traité Elémentaire de Matière Médicale. Paris, 1843. P. 254.

The different varieties of aloes differ somewhat in the degree of their action, Barbadoes being the most energetic, East Indian less so, and Cape the weakest. The Cape is generally considered as less active than the Barbadoes by nearly one-fourth, and further differs from it in being more apt to cause diuresis. In veterinary practice preference has long been given to Barbadoes aloes, perhaps, however, without sufficient reason, for the other sorts, especially the East Indian, when given in slightly larger doses, are quite as effectual, and have the advantage of being considerably cheaper. The Caballine and other inferior kinds, being very uncertain and irregular in their effects, should not be used. The purgative effect of aloes is often materially accelerated and increased by combination with other substances, not in themselves purgative, such as sulphate of iron, and most vegetable tonics and bitters. Its irritant effect on the rectum, which is sometimes an objection to its use, especially in the dog, may be mitigated by giving it in solution, and entirely prevented by combining it with other purgatives.

In the horse a cathartic dose of aloes generally causes in a few hours dryness and increased warmth of the mouth, a somewhat quickened pulse, and occasionally nausea, colic, and copious secretion of urine. This last effect is more apt to be produced by Cape aloes than by any of the other sorts ; but it occasionally occurs even with the Barbadoes, especially when the bowels have been previously much constipated, or otherwise out of order. Whenever, therefore, an ordinary dose of aloes fails to produce the desired purgative effect, the practitioner should always ascertain whether or not it has acted on the kidneys. To prevent this action he should not repeat the dose of aloes in increased quantity, as some advise, but ought to diminish the dose of aloes, and administer it in combination with jalap, a little croton, or, best of all, with one or two scruples of calomel. The time required for the operation of aloes differs much in different horses, and is modified by various circumstances, especially by the diet upon which the animal has been previously kept. A dose of six or eight drachms generally operates in about twenty-four hours. The degree and continuance of the action are also liable to considerable variation. In some horses the purging is over in two or three hours; in others it extends over twenty-four hours.

In ruminants aloes is neither a prompt nor a powerful purgative. When given to cattle even in the fluid state, and in doses of several ounces, it fails to produce copious evacuations, such as are obtained in the horse. Hertwig[1] mentions that, in an experiment made at the veterinary school of Lyons, a cow got six ounces of aloes, partly in solution, partly in electuary; but, though uneasiness and loss of appetite were observed, the bowels remained unmoved. Gilbert also gave six ounces, with an infusion of four ounces of senna leaves, without effect. Sheep and goats also take doses varying from two drachms to an ounce without being speedily or certainly purged. This tardiness and uncertainty in the purgative effect of aloes on ruminants probably depends chiefly on its vegetable nature, and its consequent resemblance to the ordinary food of the animals; on the small effect which it has on the stomach, and other anterior parts of the alimentary canal; on its acting particularly on the great intestines, which in such animals are neither very sensitive nor vascular; and on its chiefly operating by increasing the peristaltic motions, which are especially difficult to excite in ruminants.

Aloes is frequently used as a purgative for the dog; but, when given alone, is neither so speedy nor so safe as calomel and jalap, or castor oil. It has also the disadvantage of occasionally producing irritation of the rectum; but this may in great part be overcome by giving it in the fluid state, or combining it with other purgatives. The quantity of aloes required to purge a dog is unusually large as compared with the doses administered both to the human subject and to the horse. In the case of many medicines, the doses suitable for the dog and for man are very similar; but, in this instance, the dog requires eight or ten times the quantity given to man.—Aloes is a very good purge for swine, but usually takes about twelve or fifteen hours to operate.

[1] Praktische Arzneimittellehre für Thieraerzte. Berlin, 1847. P. 431.

The special cases in which aloes is administered are very numerous, particularly in the horse. It is given in constipation, in colic, and for the expulsion from the intestines of concretions, foreign substances, and worms. As a vermifuge it should be given after a long fast, in the fluid state, and with oil of turpentine; while, in addition to its exhibition by the mouth, a diluted solution ought to be injected into the rectum. In jaundice and congested states of the liver, it is usually selected in preference to other purgatives. In the treatment of febrile attacks it is of the greatest advantage, often serving all the purposes of bloodletting without leaving debility, diminishing the fluid parts of the blood, and carrying away those deleterious matters which cause or aggravate the attack. It is a most valuable auxiliary in the treatment of inflammation of almost all parts and organs (with the single exception of the intestines); as in inflammation of the brain, eye, lungs, pleura, and absorbents; and in all such cases its efficacy chiefly depends on some or all of these causes—on its drawing away blood and nervous influence from the inflamed part; on its diminishing the quantity of the blood; on its removing from that fluid many of those noxious matters which have been developed by disease, or accumulated there during its existence; and also on its clearing the intestines of undigested food and other crudities, which often occasion much uneasiness, and aggravate the original disease. Aloes is often effectual in removing œdematous enlargements and dropsies when they do not depend on debility or disease of important internal organs. It is given in plethora to diminish the amount of superfluous blood and fat, and to promote condition; but for these purposes aloes, and indeed all purgatives, should be used with much caution, as the objects which they are intended to effect are far more safely and effectually secured by judicious feeding and well regulated exercise.

In similar diseases among cattle and sheep aloes is occasionally given; but, as already stated, it cannot be so much depended on as in the horse. When used for ruminants, it should be combined with saline cathartics or croton, and given in the fluid form. For the dog it may be used in the same sort of cases in which it is given to horses; but is generally superseded by calomel and jalap, or some of the oils, which have the advantage of acting more speedily and surely.

The administration of aloes should be avoided in cases of irritation or inflammation of any part of the alimentary canal, and in piles or hemorrhage from the rectum. In bronchitis and other inflammatory affections of mucous membranes, and in inflammation of the kidneys, it must be used with great caution, and in very small doses; for in such cases the intestinal mucous membrane is unusually irritable, and superpurgation and inflammation are readily induced. During pregnancy, both in the mare and bitch, the violent operation of aloes must be carefully avoided. Some practitioners give it both to foals and calves, but for young animals linseed or castor oil is much more suitable. As a tonic aloes is little used. Like other bitter medicines, it is occasionally prescribed in cases of weakness and relaxation of the digestive apparatus, where there is impaired secretion of bile, or tendency to the production of intestinal worms. It is sometimes applied externally as a gentle stimulant and desicant, as to soft unhealthy granulations, which it speedily contracts and hardens. It also lessens the quantity and improves the quality of morbid pus.

Doses, etc.—The dose of aloes for the adult horse varies from ʒij. to ʒx., according as it is given as a mild laxative or an active cathartic. If used for the foal, the dose, until the animal is several months old, may always be readily ascertained by allowing grs. v. for every week of its age. For cattle, the dose is from ℥i. to ℥ij.; for sheep, ℥ss. to ℥i.; for dogs, ℈j. to ʒi.; and for swine about ʒiv.

As a gently stimulating tonic, the dose of aloes for any of the domesticated animals is an eighth or tenth part of that given as a purgative. The tonic doses should be given several times a day, and in combination with aromatics and astringent bitters.

In veterinary practice aloes is administered in only one or two forms. The most common and convenient is the bolus or ball, which may be made with any of the ordinary excipients. The ball-mass of the Edinburgh Veterinary College consists of equal weights of Barbadoes aloes and treacle, with two ounces of ginger to every pound of aloes. The addition of ginger, or some other aromatic, appears to render the action more speedy and easy. The ingredients are mixed over a slow fire, and constantly stirred until properly melted, great care being taken to prevent the temperature from rising too high. It should never exceed 120° Fahrenheit. The mass should be kept in air-tight jars, with closely fitting covers—the balls being made up as required. Another very good ball mass, which keeps long without hardening, and is less bulky than the last, is prepared by adding to melted aloes about a fourth of its weight of rectified spirit or oil of turpentine, which is retained by the resinous matter of the aloes, and keeps the mass soft and moist. Aloetic balls made with lard, oils, or soap are only suitable for immediate use, and if kept for any considerable time become dry and hard. This may, however, be temporarily prevented by adding a few ounces of carbonate or acetate of potash to every pound of the combination. Of the fluid preparations of aloes, the watery infusion is one of the best and most convenient. The aloes should be rubbed down in hot water, but on no account exposed to a boiling temperature. The solution should be used freshly prepared. Many practitioners employ a solution of aloes in diluted alcohol, which, though more expensive, keeps better than the watery infusion. It may be made of whatever strength is most convenient, and is best prepared by the old process of digestion.

Aloin.—During the summer of 1850, Messrs Smith, the well-known pharmaceutical chemists, Duke Street, Edinburgh, discovered, first in Barbadoes aloes, and subsequently in the other varieties, a peculiar crystalline body, which they believed to be the active principle of the drug, and called aloin. They prepare it in the following manner.[1] Barbadoes aloes is powdered with sand to prevent agglutination, macerated in successive quantities of cold water, and the solutions thus obtained mixed and concentrated in vacuo to the consistence of a syrup. This, after being kept in a cool place for two or three days, becomes filled with minute brownish yellow crystals of impure aloin, which is purified by drying between folds of bibulous paper, and by repeated solution in hot water, filtration, and crystallization. When pure, aloin is a pale

[1] See paper on Aloin, by Messrs Smith, in Monthly Journal of Medical Science. Feb. 1851.

yellow crystalline substance, breaking when in mass with a dull short fracture. It is odourless; but its taste, at first slightly sweet, soon becomes intensely and permanently bitter, and distinctly aloetic. It is entirely combustible, burning with a yellow flame and much smoke. It yields by destructive distillation a somewhat aromatic volatile oil, and a resinous residue. It is neutral to test paper. It is soluble in rectified spirit, but less so in cold water—an ounce of which dissolves about a grain of aloin. The solvent power, both of water and alcohol, is greatly increased by heat. Aloin is also dissolved by acetic acid, and alkalies forming with the latter orange-yellow solutions which deepen in colour by oxidation. Sulphuric ether dissolves it sparingly, and oil of turpentine and chloroform have little effect upon it. Watery solutions rapidly darken in colour by exposure to air and light, and when heated above 150° F., the aloin is oxidised, decomposed, and converted into a resinous substance of little activity. Its actions with nitric acid and other chemical substances are very interesting, but cannot be discussed here. When anhydrous its formula is $C^{34} H^{18} O^{14}$.

Aloin possesses exactly the same actions as the crude drug, and when first discovered was considered to be at least four times as powerful. I have, however, on two different occasions, given two drachms to healthy horses without any obvious effect; and have also repeatedly administered a scruple to dogs without observing any laxative action. In a small dog, two scruples acted moderately after ten hours.

ALUM.

ALUMEN. Sulphate of alumina and potash. $KO\,SO^3 + Al^2\,O^3, 3\,SO^3 + 24\,HO$.

Alum is found in limited quantity as an efflorescence on the surface of soils and rocks, especially in volcanic districts; and is prepared in large amount from aluminous clay, or schist, which consists of alumina, iron, and sulphur. This schist, when gently heated, moistened, and freely exposed to the action of the air absorbs oxygen, by which its metallic iron is converted into oxide of iron, and its sulphur into sulphuric acid. After the addition of water to dissolve out the sulphates of iron and alumina, the solution is slightly concentrated, and treated with chloride of potassium, which, decomposing the salt of iron, forms chloride of iron and sulphate of potash—the former remaining in solution, and the latter uniting with the sulphate of alumina. The alum so formed crystallizes out, and is further purified by repeated solutions and crystallizations. It consists of one equivalent of sulphate of alumina, one of sulphate of potash, and twenty-four of water; and is expressed by the symbol $KO\ SO^3 + Al^2\ O^3, 3\ SO^3 + 24\ HO$.

Properties.—Alum occurs in transparent, colourless, crystalline masses, with a sweet, acidulous, astringent taste. It acts like an acid on colouring matter, effloresces when exposed to the air, and when heated becomes fused, and parts with its water of crystallization. It is soluble in its own weight of water at 212°, and in eighteen times its own weight at 60°. It is best distinguished by its negative action on sulphuretted hydrogen; and its white precipitates with hydro-sulphuret of ammonia and with caustic potash. The precipitate with the latter is soluble in excess of the alkali, but reappears on the addition of muriate of ammonia.

Impurities.—It is apt to be contaminated by iron, which is discoverable by the yellow colour which it imparts to the salt, by the brown precipitate which it yields with potash, or the black precipitate with solution of tannin. But the presence of iron, though it renders alum unfit for the purposes of the dyer, does not interfere with its medicinal properties.

Actions and Uses.—Alum is irritant, astringent, and sedative. Doses of from one to two ounces given to dogs cause vomiting, unaccompanied, however, by any other symptoms. Orfila found that when the œsophagus was tied, so as to prevent vomiting, two ounces occasioned death in five hours, with symptoms of great exhaustion, and diminished sensibility. On post-mortem examination, inflammation was observed throughout nearly the whole extent of the intestines. Devergie found that four drachms of burnt alum killed a dog when the gullet was tied, whereas in ordinary circumstances two ounces were required to produce that effect. An ounce introduced into the cellular tissue of a dog's thigh, caused excessive suppuration and death in fifteen hours.[1] Moiroud says that large doses given for some time continuously exhaust the digestive organs, diminish the cutaneous transpiration, and appear capable of producing grave disorders.

[1] Pereira's Materia Medica, vol. i., p. 624.

Bourgelat found it produce phthisis pulmonalis in horses.[1] Doses of several ounces are occasionally given to cows to arrest the lacteal secretion; and though continued for some time do not produce any obvious bad effects. In its medicinal actions and uses alum closely resembles oxide and acetate of zinc, but is scarcely so active. Its astringent properties depend on its forming insoluble compounds with albumen, fibrine, and gelatine, and also in part on its affinity for moisture. By corrugating the soft animal tissues, it lessens the calibre of their blood-vessels, and so diminishes vascularity and arrests secretion. It is thus that its sedative action is established. Like other astringents, it becomes absorbed, and exercises a more or less general constringing action, drying up excessive secretions, and causing thirst. It is administered in diarrhœa and dysentery, and is often advantageously combined with opium and vegetable astringents. It was at one time much used in diabetes, and is still occasionally prescribed in passive hemorrhages, in aneurisms and dilatation of the heart, and in slow poisoning by lead. It is much employed externally, as a mild stimulant and astringent, in chronic conjunctivitis, and in many simple injuries of the skin and mucous membranes. On account of its coagulating albumen, it forms a useful application for open joints; and for this purpose may be conveniently mixed with two or three parts of wheat flour, and dusted over the opening until synovia ceases to flow.

Doses, etc.—The dose for horses and cattle is from ʒij. to ʒiv.; and for dogs, between grs. x. and grs. xx. It may be given either as a bolus, or in solution. The most convenient preparations for external use are the burnt alum, a simple watery solution, or an ointment made with one part of alum to three or four of lard.

[1] Matière Médicale, par L. Moiroud. Paris, 1843, p. 117.

AMMONIA AND ITS MEDICINAL COMPOUNDS.

AMMONIA. Caustic ammonia. Hartshorn. Spirit of hartshorn. Aqua or liquor ammoniæ. NH^4O, HO.

Liquid ammonia is generally prepared in large quantities by manufacturing chemists. It is made by triturating together equal parts of muriate of ammonia (sal-ammoniac) and slaked lime, transferring the mixture to large retorts, and applying a gradually increasing heat, until gas ceases to come off. In this process, the lime unites with the hydrochloric acid of the sal-ammoniac, and so liberates the ammonia, which is conducted into receivers containing water, in which it is freely soluble. Besides being prepared in this way, ammonia is evolved during the putrefaction and destructive distillation of organic matters, and also by passing electric sparks through a mixture of hydrogen and nitrogen.

Properties.—Aqua ammoniæ is a colourless fluid, with a pungent, penetrating odour, and a caustic alkaline taste. Its density varies with its strength, and is difficult to determine, on account of its volatility. The strong ammonia of the Edin. Phar. has the density 880, and contains, according to Dalton, 27 per cent. of gaseous ammonia. But unless well kept in closely stoppered bottles, it very soon diminishes in density from evaporation. When exposed to the air, it also speedily absorbs carbonic acid. It boils at about 100°. It unites with oils and fats, forming soaps and liniments. When heated in a small plain retort, it evolves ammonia, which is a colourless, irritant, irrespirable gas, with the same pungent odour and taste as the solution, and the composition $NH^4 O$. The strong ammonia or aqua ammoniæ fortior is too concentrated for most medicinal and pharmaceutical purposes, and a weaker solution, made by adding two and a half volumes of water to one of the stronger, is generally used. This diluted solution has the density 960, and contains 8.3 per cent. of gaseous ammonia (Dalton). Aqua ammonia seldom contains any serious impurities or adulterations. The presence of water, carbonate of ammonia, and muriate of ammonia respectively, may be discovered by the following tests :—Density 880 ; diluted nitric acid causing no effervescence ; and solution of nitrate of silver causing no precipitation, when the impure specimen is saturated with nitric acid. (Ed. Phar.)

Actions and Uses.—Liquid ammonia, in a state of concentration, and in large doses, is an irritant and peculiar narcotic poison ; and in medicinal doses, is used as a diffusible stimulant, anti-spasmodic, antacid, and diuretic, and also externally as an irritant and vesicant.

Hertwig found that half an ounce had no bad effects on horses, but that one ounce proved fatal in sixteen hours, and three ounces in fifty minutes; the latter quantity causing violent cramps and difficulty of breathing. Half a drachm of the strong solution, introduced into the stomach, and secured by tying the œsophagus, destroyed a dog in twenty-four hours, causing much uneasiness, agitation, and stupor, and leaving after death slight redness of the villous coat of the stomach (Orfila). When injected into the veins, it causes spasms, convulsions, and death, which usually occurs within a few minutes, and depends, according to Mr Blake, on a sudden arrestment of the action of the heart. The most effectual antidotes to ammonia, are vinegar and other diluted acids, with diluents and demulcents. On account of its volatility, and the rapidity with which it is absorbed, its action is speedily developed. When administered in full medicinal doses, it excites the action of the heart, and the activity of most of the secretions ; but this stimulant action, though developed with especial rapidity, is very transient. Ammonia appears to affect chiefly the spinal chord and the ganglionic system of nerves ; and does not, like alcoholic or etherous stimulants, owe its effects to its primary action on the brain proper. It is probably on this account that it acts with such unusual certainty and regularity on animals of all kinds, and of all degrees of *intellectuality*. In virtue of its activity as a diffusible stimulant, it is a most effectual agent for removing spasm. On account of its alkaline properties, it is used as an antacid, but it is not so useful and effectual for this purpose as potash or soda. It is excreted from the body by several different channels, but particularly by the kidneys and skin, both of which it stimulates to increased activity. When applied externally, it produces redness, and even vesication; but its action as a counter-irritant, though rapidly induced, is not lasting. It is given to rouse the vital powers in typhoid and debilitating diseases, as in cases of influenza, chronic bronchitis, and pneumonia, when accompanied by a soft, weak pulse and cold extremities. It often relieves congestion of the lungs brought on by over-exertion, and effectually removes hoven and tympanitis. It counteracts the spasms of colic and epilepsy, and should in the latter disease be given by the mouth, as well as cautiously inhaled. It is a valuable antidote in poisoning by prussic acid, and appears to operate beneficially by inducing a state of system directly opposed to that occasioned by the poison. For the same reason, it also proves useful in cases of poisoning by other sedatives. It is applied externally as a counter-irritant in sore throat and bronchitis, chronic rheumatism, and other chronic affections occurring in the neighbourhood of joints, and for such purposes is especially valuable in cattle practice.

Doses, etc.—The dose of the strong ammonia, as a diffusible stimulant and anti-spasmodic, is from fʒij. to fʒvi. for horses; from fʒij. to fʒx. for cattle; and from ♏v. to ♏xii. for dogs. These doses should be given repeatedly; and, on account of their pungency, must be largely diluted with water, or better still, with gruel or mucilage. For external application, ammonia is sometimes used alone, but more frequently with oil. A convenient liniment may be made with equal parts of ammonia, oil of turpentine, and linseed oil. *Spirit of Ammonia*—a solution of ammonia in rectified spirit—is occasionally used in human medicine, but for most veterinary cases is not so good as the cheaper watery solution. The Edinburgh College directs it to be prepared by conducting gaseous ammonia, obtained in the usual way from muriate of ammonia and quicklime, into a receiver containing rectified spirit, in which it readily dissolves. The spirit of ammonia of the London and Dublin Colleges contains carbonate of ammonia instead of ammonia itself, and is, consequently, less active than the Edinburgh preparation, which has a density of 845, and a strong ammoniacal odour, and does not effervesce with dilute acids. It is a useful stimulant and anti-spasmodic, and a convenient solvent for gum-resins. Its dose for the horse is from f℥i. to f℥ij.; for cattle, f℥ij. to f℥iv.; and for dogs, ♏xv. to ♏xxx.

CARBONATE OF AMMONIA. Sesqui-carbonate of ammonia. Hartshorn salt. Sal volatile. Ammoniæ sesqui-carbonas. $2NH^4O, 3CO^2$.

Professor Rose of Berlin has described twelve different carbonates of ammonia, but the only one of these used in veterinary practice is the commercial sesqui-carbonate. It is best prepared by subliming together about two parts of finely powdered salammoniac, and three parts of chalk. Mutual decomposition occurs, but, from the escape of free ammonia, the carbonate which sublimes commonly contains only two parts of base to three of acid. It occurs in white, fibrous, translucent cakes, which have a pungent, alkaline taste, and an ammoniacal odour. According to Berzelius, it is soluble in two parts of temperate water, and one of tepid water. Boiling water decomposes it with evolution of ammonia and carbonic acid. Alcohol dissolves it sparingly. When heated it sublimes; and when exposed to the air it becomes opaque and friable, and covered with a white powder owing to the formation of a bicarbonate. It is not liable to adulteration.

Actions and Uses.—The sesqui-carbonate closely resembles the alkali in its actions, but is somewhat less irritant. It is sufficiently active, however, to produce in small animals the same sort of narcotic poisoning as ammonia. Thus, Orfila records that two and a half drachms given to a dog caused gastric inflammation, tetanic convulsions, and death. It is in every day use as a stimulating tonic for all sorts of animals, being employed in the same sort of cases as those in which ammonia itself is prescribed. When mixed with some aromatic oil, as that of bergamot or lavender, and a little aqua ammoniæ, it constitutes the familiar smelling salts.

The dose of carbonate of ammonia for horses is from ʒij. to ʒiv.; for cattle, from ʒiij. to ʒvj.; and for dogs, from grs. iij. to grs. v. It is best given either in a bolus with linseed meal, or with gruel, which, however, for obvious reasons, must not be used hot.

Muriate or Hydrochlorate of Ammonia. Salammoniac. Chloride of ammonium. Ammoniæ murias. $NH^4 Cl$.

This is the salt of ammonia from which all the others are commonly procured. It may be obtained from a good many different sources, but is now prepared chiefly from the ammoniacal liquor of the gas works, which contains ammonia in various states of combination. This gas liquor is treated with diluted hydrochloric acid, or in some manufactories with common salt or impure chloride of calcium; and the solution, when slowly evaporated, yields brown crystals of muriate of ammonia. These are dried, and exposed for eight or nine days to a gentle heat in iron pots covered with leaden domes, in the interior of which the salt is sublimed in large hemispherical cakes. So prepared, the salt is colourless and translucent, and of a tough and fibrous structure. It is devoid of odour, and has a saline acid taste, and a slightly acid reaction on colouring matter. It is soluble in one part of boiling, and three of temperate water. During solution it abstracts much heat, and is consequently an ingredient of many freezing mixtures. When heated it sublimes unchanged. If mixed with lime or potash it evolves ammonia.

Actions and Uses.—In large doses it is an irritant poison, and, like other ammoniacal salts, produces peculiar remote symptoms, which are thought to depend on some special action on the spinal chord. Two ounces given to a horse caused muco-enteritis (Moiroud); two drachms destroyed a little dog in an hour (Orfila). The symptoms described as occurring in dogs are "muscular weakness, slow breathing, violent action of the heart, and tetanic spasms" (Christison on Poisons). In medicinal doses it is a stimulant and diuretic, and many also style it an alterative. It is scarcely ever used internally; but when dissolved in water or spirits, it is a favourite application for inflammatory swellings, bruises, and sprains. A good discutient lotion may be made with equal parts of muriate of ammonia and nitre, dissolving the mixture when required for use in sixteen or twenty parts of water. Such a mixture will lower the thermometer from 50° to 10° F. (Periera).

Acetate of Ammonia. Spirit of Mindererus. A diluted aqueous solution of the acetate of ammonia. Ammoniæ acetatis aqua.

Acetate of ammonia is so diliquescent that it cannot be kept in the solid state. The solution is thus prepared :—

"Take of distilled vinegar (from French vinegar in preference), twenty-four fluid ounces; carbonate of ammonia, one ounce. Mix them and dissolve the salt. If the solution has any bitterness, add by degrees a little distilled vinegar till that taste be removed. The density of the distilled vinegar should be 1005, and that of the aqua acetatis ammoniæ 1011."—(Edin. Phar.)

The solution of acetate of ammonia is clear and colourless, with a mawkish unpleasant taste, but nearly devoid of odour. It is easily distinguished by the ammoniacal odour developed by the admixture of caustic potash, and the acetous odour which it produces when heated with sulphuric acid.

Like other ammoniacal salts, it is diaphoretic and diuretic, and probably also stimulant. It has been occasionally used in febrile and inflammatory diseases, but not so frequently among the lower animals as in man. Like the muriate it is applied externally as a discutient. The dose for horses and cattle is from f℥iij. to f℥iv.; and for dogs from fʒij. to fʒiv. It is given diluted with water.

ANISE.

Anisum. Fruit of the *Pimpinella Anisum.*

Nat. Ord.—Umbelliferæ. *Sex. Syst.*—Pentandria Digynia.

The natural family umbelliferæ yields many aromatic, carminative seeds. Such are anise, caraway, coriander, and fennel.

Anise is grown in many islands of the Archipelago, and in Egypt; but the English market is chiefly supplied from Spain and Germany. The Spanish seeds are smaller, lighter coloured, and more esteemed than the German. The anise is a little yellow-brown fruit, about the size of a small oat seed, is covered by minute hairs, encircled with numerous little ridges, and possessed of an aromatic odour, and a sweet pungent taste. Like other seeds of this natural family, it may be separated into two symmetrical halves. It bears some resemblance to the fruit of the hemlock, for which it has sometimes been mistaken, but may be easily distinguished from it by its aromatic odour, and its smooth encircling ridges. Anise contains a considerable quantity of gummy matter, a little sugar and resin, with various salts, a fixed oil, and also a transparent, nearly colourless, volatile oil, which is the active ingredient of the seed, has a strong anise flavour, and solidifies at low temperatures, owing to the large proportion of stearoptin it contains.

Actions and Uses.—Anise is stomachic and carminative. It is used to relieve cases of indigestion and flatulence, to communicate an agreeable flavour to many medicines, and to diminish the nauseating and griping effects of purgatives. It was at one time frequently given to females while nursing, in the belief that it increased the quantity, and improved the quality, of their milk; and some veterinarians have thought that it exerts a similar action in cows.

Doses, etc.—The dose of powdered anise for the horse is about ℥i.; for cattle, from ℥i. to ℥ij.; for sheep and swine, from ʒij. to ʒiij.; and for dogs, from ℈i. to ℈iij. These doses may be repeated several times a day, are often conjoined with ginger or aromatics, and are conveniently administered in ale or spirit and water. The oil of anise is rather too expensive for ordinary use as a carminative, but is much used as a flavouring ingredient, especially for ball masses, and is often useful for destroying lice, especially in pet dogs and other small animals.

ANTIMONY AND ITS MEDICINAL COMPOUNDS.

OXIDE OR TEROXIDE OF ANTIMONY. Antimonii oxidum. $Sb\ O^3$.

The native oxide is found in small quantity in Saxony and Hungary, and is known as white antimony or flowers of antimony. There are many different ways of preparing the oxide used in medicine, but that generally followed consists in decomposing the chloride with water, and carefully washing the precipitated powder to free it from adhering traces of chlorine and hydrochloric acid. The oxide thus purified is a white, tasteless, heavy powder, insoluble in water, but soluble in muriatic, tartaric, and acetic acids. It is permanent in air; it fuses at a red heat; and at higher temperatures sublimes and crystallizes in acicular prisms. Professor Christison considers it a sesqui-oxide ($Sb^2\ O^3$), but most chemists now regard it as a teroxide ($Sb\ O^3$).

Two oxides of antimony form the principal ingredients of the far-famed *James's powder*, which is a mixture chiefly of antimonious acid ($Sb\ O^4$) and phosphate of lime, with some oxide of antimony ($Sb\ O^3$), and a little antimoniate of lime ($Ca\ O, Sb\ O^5$). Edin. Phar. The mode of preparing the *true* James's powder still remains a secret, but the three pharmacopœias have imitations of it, which, however, are considered inferior to the empirical medicine in activity and certainty.

Actions and Uses.—Oxide of antimony is chiefly important on account of its employment in the preparation of tartar emetic, which it closely resembles in its actions and uses. It is itself so little employed in veterinary practice that it does not require special notice. Neither the true James's powder, nor its pharmaceutical imitations, are much used in veterinary medicine, nor would their introduction be of much advantage, since they are chiefly serviceable as diaphoretics, and amongst the lower animals are in no way superior to tartar emetic.

SULPHURET OF ANTIMONY. Antimonii sulphuretum. $Sb\ S^3$.

This, the most valuable and abundant ore of antimony, is popularly known as grey or black antimony. When purified by fusion, it occurs in grey-coloured, metallic, heavy, brittle cakes, devoid of odour and taste, and known as crude antimony. Many modifications of the sulphuret have at various times been used in medicine. Some of the most important of these are—*Glass of antimony*, "an irregular mixture of oxide of antimony with a definite compound of the oxide and sulphuret;" *liver of antimony*, "a double sulphuret of antimony and potassium;" *Kermes mineral*, believed to be a hydrated sulphuret, or, according to Rose, an amorphous sulphuret of antimony with sulphantimoniate of soda or potash; *golden sulphuret of antimony*, a "hydrated sulphuret with an admixture of oxide;" and *crocus of antimony*, "a definite compound of one equivalent of oxide and two of sulphuret." (See Christison's Dispensatory.)

Actions and Uses.—Being uncertain, irregular, and often violent remedies, the sulphurets of antimony are now discarded from human medicine, and should also we think be discarded from veterinary practice. Their irregularity of action probably depends in great part on their being of very variable composition, and insoluble in water. All of them are considered alterative, and anthelmintic, and are usually given to horses in doses of one to three drachms along with sulphur or nitre. They act as emetics for dogs, but are not now used as such.

CHLORIDE OR TERCHLORIDE OF ANTIMONY. Muriate of Antimony. Oil or butter of Antimony. Antimonii chloridum. $Sb\ Cl^3$.

This familiar caustic is prepared by digesting the native sulphuret with hydrochloric acid, and colouring the solution with pernitrate of iron. It is a transparent red-brown liquid, varying in hue according to the proportion of nitrate of iron which it contains. Its specific gravity ranges between 1200 and 1500. From containing excess of hydrochloric acid, it has an acid reaction, and fumes on exposure to air. The addition of water causes the separation of a white precipitate of subchloride, which if washed yields a pure oxide.

Actions and Uses.—It is now used only as a caustic, and that less often than formerly. It is still, however, employed in the treatment of fistulæ, thrushes, canker, and luxuriant granulations; and is besides an especial favourite with many practitioners in cases of foul in the feet of cattle, and foot-rot, the analogous complaint in sheep. In these cases many prefer it to other caustics as more effectual, and at the same time less apt to produce excessive pain, and corrosion of neighbouring parts. It cannot be much diluted without undergoing decomposition, and since, therefore, it must be used in a concentrated state, it should be applied with caution.

TARTARIZED ANTIMONY. Tartar emetic. Tartrate of potash and antimony. Antimonium tartarizatum. $KO, Sb O^3, \bar{T}+2 HO$.

The simplest and best process for making tartar emetic is that pursued by the Edinburgh and Dublin Colleges, and briefly stated in the following words :—

"Take of sulphuret of antimony in fine powder four ounces; muriatic acid (commercial) one pint; water five pints. Dissolve the sulphuret in the acid with the aid of a gentle heat; boil for half an hour; filter, pour the liquid into the water; collect the precipitate on a calico filter, wash it with cold water till the water ceases to redden litmus paper; dry the precipitate over the vapour bath. Take of this precipitate three ounces; bitartrate of potash four ounces and two drachms; water, twenty-seven fluid ounces. Mix the powders, add the water, boil for an hour, filter, and set the liquid aside to crystallize. The mother liquor when concentrated yields more crystals, but not so free of colour, and therefore requiring a second crystallization."—(Edin. Phar.)

These directions scarcely require explanation. The chloride obtained from the native sulphuret is decomposed by the action of water. The impure oxide thus thrown down is purified by water, and boiled with bitartrate of potash, when the tartaric acid, being a bibasic acid, unites with the oxide of antimony to form a double tartrate of potash and antimony. This is tartar emetic.

Properties.—It is sold in the shops in two distinct forms; in a white powder, and in colourless transparent octohedral crystals, which become opaque when exposed to the air, and crepitate when heated. It is devoid of odour, but has a sweetish, styptic metallic taste. It is insoluble in strong alcohol, but soluble in weak spirituous fluids, as wine and proof spirit. It is dissolved in about fifteen parts of temperate water, and three of boiling water. The watery solution reddens litmus, and spoils if long kept. It is decomposed by strong acids, alkalies, alkaline earths, and their carbonates (and consequently by most spring waters), as also by decoctions of cinchona and galls, and other tannin-containing substances. Tartar emetic is easily identified by its giving with sulphuretted hydrogen an orange-red precipitate of hydrated sulphuret, which is soluble in excess of the precipitant, and forms, with hydrochloric acid, a yellow solution yielding, when diluted with water, a white precipitate of the oxide. When tartar emetic or other salts of antimony occur in coloured organic solutions, the best method of detecting them is to add to the solution zinc and sulphuric acid, which cause the evolution of antimoniated hydrogen ($Sb\ H^3$), which may be ignited as it passes from a gas jet. If a bit of cold glass or porcelain be held close over the flame, it becomes speedily coated with metallic antimony, which may be easily identified by dissolving it in acidulated water, and treating the solution with sulphuretted hydrogen.

Impurities.—Tartar emetic is liable to only two common impurities, viz., oxide of iron and bitartrate of potash. The former readily discovers itself by the yellow or brown colour it imparts to the salt; while the latter, which is present in considerable quantity in many commercial specimens, diminishes its solubility. To lessen the chances of adulteration, purchasers should adopt Professor Christison's suggestion of procuring their tartar emetic in crystals, instead of powder, as any impurity would then be far more readily discoverable.

Actions and Uses.—The action of tartar emetic differs much in the different domesticated animals. Dogs, pigs, and men, are greatly more susceptible of its various actions than horses or cattle, which resist entirely its emetic action, and are brought under its irritant and cathartic effects only by the administration of doses of three or four ounces given in solution. Quantities of from one to eight drachms seldom have much effect on horses, even when given repeatedly. They do not, at least for a considerable time, induce nausea; they improve rather than injure the appetite; they neither augment nor diminish the evacuations, and disturb neither the circulation nor the respiration. These statements, though somewhat at variance with the generally received opinion, and with the results of various experiments made at Alfort, and reported in the "Veterinarian" for 1847, pp. 152-166, are fully borne out by a number of experiments lately made at the Edinburgh Veterinary College by Mr Barlow and myself. As these experiments are as yet unpublished, it may be as well to notice one or two of them somewhat in detail.

CASE I.—On 9th September 1852, about 10 A.M., a brown mare, unfit for work on account of lameness, with the pulse 38, and respirations 7, got ʒiij. of tartar emetic in a ball made up with treacle and linseed-meal. In the evening the pulse was unaffected, and the dose was repeated.

10th.—The pulse was 40, the respirations 7, appetite good, bowels and kidneys regular. A dose of ʒiv. was given morning and evening.

11th.—At 10 A.M. the pulse was 42, respirations 7, appetite and bowels quite normal. Got ℥i. in ball as before. In the evening the pulse was 40, no perceptible nausea, appetite good, bowels and kidneys regular. Dose of ℥i. repeated.

12th.—In the morning the pulse was 37½, somewhat weaker than yesterday, but still firm. The appetite was very good, and there was no change in the state of the kidneys or bowels. Got a dose of ℥i. In the evening the pulse was 40, and the patient in other respects as in the morning. Gave ℥i., being ʒxlvi. in four days.

13th.—At 10 A.M. the pulse was 35, the appetite good, and the bowels and kidneys normal. About 11 A.M. the animal had dropped or lain down, and while lying the pulse was somewhat irregular, varying between 60 and 70. The respirations were quiet. At 12 the animal was lifted, when the pulse fell in a few minutes to 55, and the respirations to 6. The appetite still remained very good. Gave ʒx. in the usual way. In the evening the pulse was 40, the same as in the morning, the respirations 6, the appetite and evacuations natural. Gotx ʒxiv.

14th.—10 A.M. No change from last night. Got ℥i.; but when having it put over, the animal ran back, and went down. At 1 she was raised, still continued to eat, and at 1.30 got another dose of ℥. She remained down all day, and appeared nauseated. The pulse was not quite regular, probably owing to the occasional struggling, but reached about 60 when at its maximum. Respirations about 12. At 6.30 the animal was still eating and drinking, but only sparingly; the pulse 75, and weak; the animal much nauseated, and lying pretty quiet, with the lips much retracted.

15th.—10 A.M. Found dead, having taken ʒlxxxvi. of tartar emetic in six days. Mr Barlow made the following notes of the post-mortem examination:— The muscular tissue in every part of the body was unusually flaccid, although the rigor mortis was well established. The right lung, which was the lowermost as the animal lay, was much congested in its deeper and central parts; the several margins were comparatively pale; at the anterior part of the anterior lobe there was much emphysema. The left lung was perfectly healthy, and not at all emphysematous. The bronchial tubes and smaller bronchii in both lungs contained frothy mucus. The pleura and pericardium were in every way healthy. The heart was very large, in consequence of all its cavities being filled with firmly coagulated blood. At the junction of the villous and cuticular coats, the stomach was much contracted, and exhibited a slight blush, not amounting to redness. The cuticular coat was marked with several indentations, such as are produced by bots; but in all other respects the stomach was perfectly healthy. The intestines were also perfectly healthy, both within and without. The liver was in a state of cirrhosis, such as is often seen in old and worn-out horses. The organs of urination and generation were quite normal. The brain was healthy, but the subarachnoid spaces contained a considerable quantity of fluid.

Case II.—A mare, about 16 hands high, and in good health and condition, got ʒiij. of tartar emetic daily, in the form of a bolus, for five days, and then ʒvi. daily, for thirteen days, making in all ʒlxxxiij., in eighteen days; but without exhibiting any physiological effect. The animal was destroyed by cutting the carotid artery, but the post-mortem examination discovered nothing at all abnormal. It may be mentioned that, on the twelfth day of experiment, twenty ounces of urine were removed, and found to contain a perceptible, but not very large, quantity of antimony.

Case III.—A black mare, of sound healthy constitution, took ʒlxxxiv. of tartar emetic (in doses of ʒiv., repeated twice and thrice a day) during the ten days from the 16th to the 24th of September 1852; yet she was in no way affected by it; her pulse and respiration were scarcely at all altered; her appetite throughout was voracious; her evacuations natural in appearance and quantity; and her condition considerably improved. She was poisoned by a fluid drachm of Fleming's tincture of aconite. On dissection, not a single morbid appearance referrible to the tartar emetic was observed. The stomach and intestines were carefully examined, and found "beautifully healthy."

Case IV.—A healthy, well-bred horse got ℥x. of tartar emetic in solution, and after showing a good deal of nausea, uneasiness, and pain, died in about six hours. The only notable appearances on post-mortem examination, were softness and vascularity of the intestines, analogous to what is seen in patients that have died while affected by diarrhœa. Neither in this, nor in any of the other cases, were the lungs congested or inflamed, as is said to have occurred in Magendie's experiments.

These cases, with several others of a similar kind which might also have been adduced, clearly show that single doses of tartar emetic sufficient, if retained in the stomach, to destroy from thirty to forty men or as many dogs, may be given to horses with impunity; that doses of from one to eight drachms may be administered to them in the solid form for days, or even weeks, without producing any very obvious physiological effects; and that doses of several drachms, even when given in the form of solution, in which the medicine is certainly far more active, fail to produce any marked depression of the action of the heart, or any diminution in the force and frequency of the respirations.

Cattle, like horses, can take very large doses of tartar emetic without suffering from any of the physiological actions of the drug. Hertwig and Viborg gave quantities varying from two to ten drachms, and Gilbert gave ten drachms in solution—all without effect.—(Hertwig's Arzneimittellehre). We have repeatedly administered an ounce twice a day to cattle affected by pleuro-pneumonia, and, except in a few cases where purgation occurred, have watched in vain for any evidence of its action. Mr Balfour, V.S., Kirkcaldy, informs me that he has given half a pound in solution without any very obvious effects. By doses proportionate to their size, sheep are acted on much in the same way as cattle. Viborg gave one drachm, and Gilbert three drachms in solution, and four in the solid state without effect. (Hertwig). But the latter found that four drachms destroyed a one-year-old sheep.

The effects of tartar emetic on dogs are much the same as on man. Doses varying from six grains to half an ounce are speedily expelled by vomiting, if the animals be left to themselves; but if the gullet be tied so as to prevent vomiting, such doses cause nausea, accelerated and difficult respiration, fluid dejections, intestinal irritation, and death in a few hours. Hertwig mentions that it is not so active in pigs as is generally believed; that from ten to twenty grains cause nausea and vomiting, but act neither very rapidly nor very certainly; that one drachm in solution given to a boar nine months old caused vomiting, dulness, and uneasiness, which continued for three days; and that two drachms given to a similar animal killed it within twenty-four hours.

Tartar emetic has much the same effect when placed in the cellular tissue, or injected into the veins, as when given in the usual way. In any case it becomes speedily absorbed. It has been detected in the blood and in most of the soft tissues, especially in the liver and kidneys, from the latter of which it is chiefly excreted. (Orfila).

The therapeutic applications of tartar emetic are very numerous. It is generally considered a most valuable antiphlogistic for horses and cattle, and is especially prescribed in febrile complaints, pneumonia, pleurisy, bronchitis, and most local inflammations, except those of the alimentary canal. In all such cases it is said to be very effectual, especially when the more acute symptoms are partially subdued by bleeding. But many of the most eminent veterinary practitioners, both in England and Scotland, have now entirely abandoned the use of tartar emetic for such cases amongst horses and cattle, and rightly consider it perfectly useless. Indeed, the only evidence in favour of its possessing any curative action in such circumstances is derivable from cases in which it has been used in conjunction with medicinal and hygienic remedies, which are in themselves most effectual means of cure. Apart, however, from practical experience, it appears highly improbable that tartar emetic should have any active therapeutic effect either in horses or cattle, since in these animals it is, as already mentioned, altogether devoid of physiological action. Many regard tartar emetic as a useful vermifuge, and give it for this purpose to horses, along with epsom salts or other purgatives. The mixture is really sometimes effectual, not, however, from any special anthelmintic action, but from the smart purgation which tartar emetic always induces when given along with a cathartic.

Among dogs, cats, and pigs, tartarized antimony is very useful as a nauseating emetic ; and is advantageously used in most febrile and inflammatory complaints, relieving engorgement of the stomach and intestines, depressing the action of the heart, and causing a copious secretion from most of the mucous surfaces. It does not operate so speedily as sulphate of zinc or of copper, but is preferable to these in febrile cases, since its emetic action is of longer duration, and accompanied by a greater amount of nausea. On these accounts, however, it is less suitable for simply emptying the stomach of food or poisons.

When rubbed into the skin, tartar emetic causes much irritation, inflammation, and swelling, with an eruption of minute crowded vesicles, which soon become converted into pustules. Unlike cantharides, it has no tendency to act on the kidneys; but is occasionally absorbed, and produces in dogs the same effects as follow its administration by the mouth. Unless used with considerable caution, it is apt to induce deep-seated inflammation, sloughing, and blemishing; and is consequently little employed in this way, either for horses or dogs. For cattle, however, it is a useful counter-irritant, being chiefly applied in chest diseases, and chronic rheumatism of the joints.

Doses, etc.—The usual dose for horses or cattle is ʒi. to ʒiv., administered three or four times a day either in bolus or solution. As an emetic for dogs or cats the dose varies from gr. i. to grs. iv. It may be given in a bolus or rolled up in a bit of meat, but is most effectual in solution. In quantities insufficient to produce vomiting, as in doses of one grain or less, it is used in these carnivora for inducing nausea in inflammatory and febrile complaints. For similar purposes in horses and cattle the dose is generally united with several drachms of nitre; two or three scruples of calomel; a few ounces of salts; or a few drachms of aloes—the last mixture being with some practitioners a favourite purgative in cases of acute febrile complaints. One to two grains, with about the same quantity of calomel, is often given to dogs to arrest inflammation. Such a mixture causes vomiting, and subsequently purgation, accompanied by much depression. Tartar emetic is used externally as a counter-irritant in the form either of solution or ointment, which latter is usually made with one part of tartar emetic and four of lard, and is sometimes added to ordinary blistering ointments to increase their activity.

ARSENIC.

White Arsenic. Arsenious acid. Arsenicum album. $As O^3$.

Arsenious acid is rarely found native, but is often associated in considerable amount with ores of iron, tin, and cobalt. When these are roasted it is evolved, and accumulates in an impure form in the furnace flues. It is then purified by one or two sublimations. It is usually prepared in this way from the tin ores of Cornwall.[1]

Properties.—From its being sublimed in conical cast-iron kettles, it occurs in large brittle masses, which are of a concavo-convex form, and exhibit on their interior surface minute octohedral crystals, with triangular facets. It has a snow-white lustrous appearance, and a slightly sweetish taste, is rough and gritty when between the teeth, and if kept in the mouth for a short time causes irritation. It has no odour. When long kept it loses its transparency, and becomes quite opaque. The density of the transparent variety is 3.69, that of the opaque 3.73. It requires for solution nine times its weight of boiling water, and about 400 times its weight of temperate water. Its solubility is increased by the presence of acids, but diminished by that of organic matter.

Chemical Tests.—The special tests for the detection of arsenious acid are easy and distinctive.

1*st*, When heated in a common test tube to about 380°, it sublimes unchanged, and condenses again in the cool part of the tube in shining crystals, which, when examined with a pocket lens, are found to be regular octohedrons, or portions of such octohedrons, exhibiting faces which are equilateral triangles.

2*d*, A mixture of arsenious acid and carbonaceous matter (and for this purpose, powdered cyanide of potassium answers best) is introduced into one of those test tubes specially made for testing arsenic, and having a narrow neck and small bulb. The mixture being heated to redness, the acid is decomposed, and its oxygen liberated, while metallic arsenic volatilises as a colourless gas, with a strong odour of garlic, and condenses in the narrow part of the tube, forming a brilliant steel-grey incrustation. This is dark-coloured and smooth externally, and lighter and more crystalline, rough, and shining internally. When the narrow part of the tube is cut out, put into a common test tube, and

[1] Pereira's Elements of Materia Medica, vol. i. p. 640.

heated, the metallic arsenic regains the oxygen which it previously lost, and a crust of arsenious acid, with its characteristic appearance, forms in the cool part of the tube.

3*d*, When this white crust has been boiled with a little water acidulated with hydrochloric acid, or when white arsenic is otherwise in a state of solution, there are three other tests by which it may be readily identified—(*a*) Sulphuretted hydrogen gives a brilliant yellow precipitate of sulphuret of arsenic ($As\ S^3$) or orpiment. (*b*) Ammonio-nitrate of silver (prepared by adding ammonia to nitrate of silver, until the precipitate which first falls is almost wholly redissolved) gives a primrose-yellow precipitate of the arsenite of silver ($Ag\ O, As\ O^5$). (*c*) Ammonio-sulphate of copper (prepared in a similar manner to the ammonio-nitrate of silver) gives an apple-green precipitate of arsenite of copper ($Cu\ O, As\ O^5$), commonly known as Sheele's green. Although these liquid tests, when taken individually, are not quite free from fallacy, still all of them together afford adequate evidence of the presence of arsenic, and this evidence will of course be still further strengthened by obtaining the peculiar crystals of arsenious acid, and afterwards reducing them to the metallic state.

When arsenic is contained in the contents of the stomach, the tissues of the body, or in any coloured organic mixture, the tests mentioned are quite inapplicable until the arsenic be isolated. To effect this, three different *processes* are in common use.

1*st*, The mixture is boiled, with the addition of water if necessary. It is then filtered, acidulated with hydrochloric or acetic acid, subjected to a stream of sulphuretted hydrogen, and again boiled. A yellow precipitate of sulphuret of arsenic will gradually appear, and its nature may be readily demonstrated by washing, drying, and heating it in a tube with cyanide of potassium, or a mixture of charcoal and carbonate of soda, when metallic arsenic will volatilise, oxidise, and condense in the characteristic crystals of arsenious acid, which may further be reduced to the metallic state, or subjected to the liquid tests already mentioned.

2*d*, The mixture is acidulated with muriatic acid, and boiled for some time with a few copper clippings, on which the metallic arsenic collects as a dark crust. The clippings are then put into a test tube, and cautiously heated until a ring of arsenious acid lines the cool part of the tube. Indubitable evidence of the nature of this sublimate may be had by dissolving it in acidulated water, and applying the tests for arsenic in solution. This is generally known as Reinsch's process, and is very simple, and so delicate that it will detect at least one 250,000th part of arsenic in solution. (Christison).

3*d*, The mixture placed in a Wolf's bottle, a Döbereiner's lamp, or other convenient apparatus, is treated with zinc and sulphuric acid. Hydrogen is set free from the decomposition of the water, and unites with the metallic arsenic of any arsenical compound present. The arseniuretted hydrogen ($As\ H^3$) so formed may be decomposed by heating the glass tube through which it passes off, and the crust of metallic arsenic which is deposited may be subjected to examination in the usual way. Or, if the end of the exit tube be narrowed, and the gas ignited, a bit of glass or porcelain held over the flame will soon become encrusted, either with metallic arsenic, or arsenious acid, according to the distance at which it is kept from the flame. This elegant method of extracting arsenic from complex fluids is called Marsh's process. Mr Morton of the London Veterinary College has proposed a very delicate and ingenious method of evolving arseniuretted hydrogen from fluids containing arsenic, without the use of zinc and sulphuric acid, by passing a galvanic current through them. The gas thus evolved is subjected to the same examination as in Marsh's process.

Actions and Uses.—Arsenious acid is an irritant poison, a tonic, and an antiseptic.

It acts on all animals as a destructive poison. It causes irritation, inflammation, and sloughing of any part with which it comes in contact; is readily absorbed; produces, while it remains in the system, loss of appetite, emaciation, various nervous disorders, and depression of the circulation; and appears to be excreted through the various mucous surfaces, especially through that of the alimentary canal, producing as it passes through them violent and often fatal inflammation. It exerts its poisonous action with nearly equal certainty by whatever channel it enters the body. All its compounds are poisonous; and as usual with other poisons, the most soluble are the most active. Arseniuretted hydrogen is probably the most deadly of all its compounds, having occasioned the death of three chemists who were so unfortunate as to inhale small quantities of it. Orfila found that the sulphurets, in doses of forty to seventy grains, destroyed dogs in two to six days, and had much the same effect whether they were given in the usual way, or applied to a wound. Metallic arsenic is alone devoid of poisonous action.

Arsenious acid, like all other mineral poisons, has been given to horses in very considerable doses with impunity. Berthe gave a mare affected with inveterate mange two, and afterwards three, drachms without injury.[1] Beissenhirz gave a horse one, four, three, two, and eight drachms on different successive days; but death occurred on the ninth day after the last dose.[2] Hertwig gave it to eight different horses, first in doses of a scruple, but gradually increasing the quantity to a drachm. He continued the administration for thirty or forty days, but observed

1 Recueil de Medicine Vétérinaire, Oct. 1825. Quoted by Moiroud, p. 466.

2 Pereira's Elements of Materia Medica, vol. i. p. 606.

no bad consequences, either during the use of the poison or afterwards. The pulse became a little stronger and harder, and in some of the cases the condition improved.[1] Mr William Percivall, experimenting on a horse affected with glanders, began with one drachm daily made into a bolus with linseed meal and treacle; increased that dose by a scruple per day, and continued the medicine for seventeen days. On the seventeenth day the animal got, in one dose, ʒvi. ℈i., and had then taken ℥vij. ʒvi. ℈i., or very nearly half a pound of arsenic. Yet no physiological effect was obvious, no loss of appetite, no uneasiness or pain, and no alteration of the pulse or respiration.[2]

But although such large doses have usually little or no effect, it is found that much smaller doses occasionally act with greater violence. Thus Gerlach saw twenty grains cause active diarrhœa; and Mr Percivall mentions that two glandered horses, getting five grains of arsenic daily in the form of bolus, were attacked, one on the eighth and the other on the ninth day, with shivering, loss of appetite, nausea, purging, and other symptoms of abdominal irritation, imperceptibility of the pulse and prostration of strength. One died, the other recovered.[3] It is scarcely possible to explain why doses of five grains should act so powerfully in eight or nine days; whilst upwards of a drachm has been given daily without effect for a longer time. It may be that these different effects depend on variable degrees of susceptibility in the subjects experimented on; or more probably, perhaps, on the large doses producing such changes on the coats of the alimentary canal, as prevent in great part the absorption of the poison. And it is so far consistent with this view, that arsenic given in solution is greatly more certain, regular, and active than when in the solid state. Thirty grains given daily, dissolved in carbonate of potash, destroyed a horse in four days.[4]

It requires somewhat larger quantities of arsenious acid to destroy cattle than horses, probably because their stomachs are

[1] Praktische Arzneimittellehre für Thieraerzte. Berlin, 1847, p. 656.
[2] Veterinarian for 1843, p. 347.
[3] *Ibid*, 1843, pp. 349-351.
[4] *Ibid*, 1843, pp. 350-1.

generally filled with food, which interferes with the action of the poison. An ounce of arsenic given with a handful of salt to a strong sheep caused most of the symptoms above mentioned as occurring in horses, and death after five days.[1] Hertwig, quoting from a report of the French Academy, mentions that from five to ten grains given to sound sheep produced the usual symptoms of poisoning; that a second dose of from ten to twenty grains given twenty-four hours after caused death; and that, on examination, the poison was found in the blood, urine, lungs, liver, and muscles. The carcasses of sheep poisoned by arsenic have been eaten by dogs with impunity.[2] A chronic form of arsenical poisoning, with symptoms of indigestion, thirst, gradual sinking, and chronic diseases of the joints and bones, is sometimes met with among both cattle and horses in the neighbourhood of the tin and copper smelting furnaces of Cornwall and Wales.

Arsenic is greatly more active in dogs and cats than it is in horses or cattle. From a quarter of a grain to a grain given twice daily, and continued during from eight to fourteen days, caused in these small animals gradually diminished appetite and vomiting. After a period varying from six to ten days diarrhœa, rapid emaciation and painful cough ensued, and death occurred in from twenty to thirty days. Quantities of from three to ten grains, mixed with water, and administered to dogs, caused in a few minutes nausea, vomiting, short moaning, difficult breathing, a wiry, rapid pulse of 120 or upwards, and black evacuations made with considerable pain. These symptoms were accompanied by a look of extreme anguish, blunted perception, and death with convulsions followed in from six to thirty hours. Arsenic produces similar effects both on pigs and poultry.

The post-mortem appearances of poisoning by arsenic are very similar in all animals, but differ a good deal with the severity and duration of the case. The carcass, when opened, generally evolves large quantities of a very fœtid gas. In the horse the cuticular part of the stomach is not usually much altered, but

[1] Veterinarian, 1843, p. 345.   [2] *Ibid*, 1843, p. 345.

the villous is reddened, softened, thickened, and disorganized by patches of inflammation and extravasation of blood, which extend into the duodenum, and are also observable in the colon and cecum. The lungs are usually congested, and their mucous membrane, as also that of the urino-genital organs, is very red and vascular. These appearances present themselves, not only when the poison has been swallowed, but also when it has been absorbed from the surface of the skin.[1] The bodies of animals poisoned by arsenic do not undergo the usual form of putrefaction, but become dry and mummified, the cellular tissue, brain, lungs, and some other parts becoming greasy and tallow-like.

In the treatment of cases of arsenical poisoning, the first object must be to get rid of any poison still remaining unabsorbed, by the administration of emetics; or, where these are ineffectual, as in horses or cattle, by the use of the stomach pump. The hydrated sesqui-oxide of iron is the best of the various antidotes hitherto proposed, and is most active when prepared by precipitating a sesquisalt of iron with ammonia, washing the precipitate with warm water, and administering it moist. It should be given as soon as possible, and in a quantity at least twelve times greater than that of the poison. It appears to act by uniting with the arsenious acid to form an insoluble arsenite. Magnesia is another antidote which appears, like the last, to render arsenious acid insoluble. It is most effectual when given in the gelatinous form prepared by precipitating a solution of epsom salts with caustic potash. Certain insoluble powders, as charcoal and clay, act as mechanical antidotes, enveloping the particles of the poison, and protecting the coats of the stomach from its action. But such antidotes, to be of any use, must be given along with, or immediately after, the poison. The most useful means for removing the remote effects produced by poisonous doses of arsenic are bloodletting, large doses of opium and demulcents, where the inflammatory symptoms are high; oleaginous laxatives and clysters, where there is constipation and griping; and

[1] Veterinarian, 1843, p. 680.

in all cases plenty of good and easily digested food, with occasional diuretics, which are highly recommended by Orfila, and are further indicated by the fact that the kidneys appear to be one of the chief channels by which arsenic is excreted from the system.[1]

Arsenious acid is seldom used in veterinary practice except empirically. It appears to act as a tonic, and in the human subject as an anti-periodic, but in the lower animals this action has not been well observed. The diseases for which it is chiefly prescribed are chronic rheumatism, mange, and epilepsy in dogs. In the treatment of glanders, farcy, and consumption, in which it was once commonly prescribed, it has now fallen into well-merited disrepute. In some parts of continental Europe it is regularly given to horses in small doses; and is said to be effectual in maintaining condition, and imparting strength and endurance. In some countries it is also eaten by many of the people, in the belief that it increases the general vigour. It is much used externally, for stimulating unhealthy ulcers, curing scab, mange, and other cutaneous diseases, destroying vermin in the skin, and producing the sloughing and removal of malignant tumours. For such purposes, however, it must ever be used with the greatest caution, for many animals have been destroyed by its injudicious application, both to wounds and to the skin; and many more have been permanently blemished by the excessive sloughings which it produces when applied to the surface in any considerable quantity. In virtue of its antiseptic properties, it has been sometimes used to preserve subjects for dissection.

Doses, etc.—The dose for horses and cattle is from grs. v. to grs. x.; and for dogs from gr. $\frac{1}{15}$ to gr. $\frac{1}{10}$. To obtain its therapeutic effects it is generally believed necessary to give it for some time; but whenever it causes any physiological action, as acceleration or hardness of the pulse, tenderness of the conjunctiva, indigestion, or diarrhœa, its administration must be stopped. It must be remembered that, with all animals, and in all doses, it is most active when administered in solution. Hence, it is best

[1] Veterinarian, 1843, p. 345.

given in acidulated water, or in the form of the *liquor arsenicalis*, or Fowler's solution, which consists of arsenious acid and a little arsenite of potash dissolved in a solution of carbonate of potash, and coloured with tincture of lavender. Every ounce of this solution contains four grains of arsenious acid. The London and Edinburgh colleges direct it to be thus made :—

"Take of white arsenic in powder, and carbonate of potash, of each four scruples; compound tincture of lavender five fluid drachms; and water one pint: dissolve the oxide and carbonate together in half the water, with the aid of heat; filter if necessary; add the tincture to the liquid when cold, and then dilute it with water till the whole measure one pint."—(Ed. Phar.)

Fowler's solution is suitable for external as well as internal use ; but where a solution is inconvenient, an ointment made with six grains to an ounce of lard may be used. It cannot, however, be too often repeated that all arsenical preparations, whether for internal or external purposes, must be used with great circumspection.

ASSAFŒTIDA.

Gummy resinous exudation of *Narthex Assafœtida*, and probably of other species.

Nat. Ord.—Umbelliferæ. *Sex. Syst.*—Pentandria Digynia.

Most of the best assafœtida brought to this country is the produce of the *Narthex Assafœtida*—a plant with a disagreeable fœtid odour, a long black perennial root, large pœony-like annual leaves, and a tall, fleshy, flowering stem, terminating in a cluster of flowers. The plant grows luxuriantly in Persia and India, and a fine specimen may now be seen in the Edinburgh Botanical Garden. When the plants are four years old, the leaves and stem are removed, and some time after a slice is cut from the upper part of the root. The fœtid milky juice exudes from the freshly cut surface, and as it concretes is scraped off. Fresh slices of the root are removed at short intervals, until the plant is entirely exhausted. The little tears first collected are usually agglutinated into irregular lumps, which have externally a red-brown colour, and within a white waxy surface, which, however, becomes gradually red on exposure to the air. Assafœtida has a disagreeable, penetrating, garlicy odour, and an intensely bitter acrid taste. It is pulverised with difficulty, forms an emulsion with water, and is dissolved in rectified spirit, and also in potash and ammonia. It contains 48.8 per cent. of resin; 25.8 of gum; 4.6 of volatile oil; 10.5 of salts; besides water and impurities.

Actions and Uses.—Assafœtida is a mild diffusible stimulant, carminative, and vermifuge. It is speedily absorbed, and, by its disagreeable odour, soon renders its presence appreciable in the breath, perspiration, matter of abcesses, and even in the muscles. Hertwig, however, could not recognise it in the milk or urine of cows or horses getting five ounces daily. It acts very mildly both on horses and cattle; and is little used except occasionally in cases of colic, in chronic coughs, and in chorea in dogs. It is also, however, like other substances containing odorous volatile oils, a vermifuge; and for this purpose may be given either by the mouth or rectum. The two gum-resins, *ammoniac* and *galbanum*, are closely analogous to assafœtida, but scarcely so active. They are occasionally used for the same purposes and as constituents of charges and plasters.

Doses, etc.—The dose of assafœtida for horses is about ʒij.; for cattle about ʒiv.; and for dogs grs. x. to grs. xx. As its stimulant effects are very transient, it requires to be given repeatedly; and is most conveniently administered in a watery or alcoholic solution of ammonia. It is often conjoined with camphor and carbonate of ammonia.

AXUNGE.

Axungia. Hog's Lard.

Most parts of the fat of the pig are used for making lard; but that about the internal organs and loins is chiefly preferred, on account of its greater firmness and density. To get rid of the cellular and vascular tissue mixed with it, the fat is beat up in a mortar with cold water, is then melted over a slow fire with constant stirring, filtered through linen, and, while liquid, poured into pots or bladders. When pure, it is a white, or yellowish-white, granular-looking substance, having no odour, but a sweetish taste. It melts at about 90°, forming a clear transparent fluid, which is a good solvent for wax and resins, and when boiled with alkalies forms soap. Like other fats and oils, lard is insoluble in water, slightly soluble in alcohol, but quite soluble in ethers and oils. If exposed to the air it becomes rancid, and in this state is unfit for emollient purposes. It contains about 62 per cent. of oleine, and 38 per cent. of stearine and margarine. *Suet*—the fat around the kidneys of the sheep or ox—is sometimes used instead of axunge, and differs from it chiefly in being firmer, harder, and less easily melted. Horses' fat is more easily melted, and firmer than that of swine.

Actions and Uses.—Fats and mild fixed oils, which are merely fluid fats, when given without other sorts of food, are quite inadequate to support life; thus dogs, receiving only butter and olive oil, with distilled water to drink, died in about thirty-six days. In a well regulated system of diet they serve, however, various important purposes; they are employed along with flesh or other nitrogenous matters in the formation of cells; are consumed in the body for the support of animal heat; or are stored away in different parts for investing and protecting important organs. Although small doses are easy of digestion, large quantities disorder the digestive functions, and cause diarrhœa. Hog's lard is occasionally used as an internal demulcent, as an antidote for poisoning with alkalies, and as a laxative clyster. It is also applied externally as a simple dressing for ulcers and blistered surfaces, softening and protecting them from the action of the air, and of acrid discharges. It is sometimes effectual in removing mange, scab, and similar complaints, and appears to act simply by preventing access of air to the minute acarus on which these diseases are believed to depend. It is much used for making ointments and liniments.

BALSAMS OF TOLU AND PERU.

BALSAMUM TOLUTANUM. Concrete Balsamic Exudation of *Myrospermum Toluiferum.* (Ed. Phar.)

BALSAMUM PERUVIANUM. Fluid Balsamic Exudation of *Myrospermum Peruiferum*, or of an allied species *M. Pereiræ.* (Royle.)

Nat. Ord.—Leguminosæ. *Sex. Syst.*—Decandria Monogynia.

Balsam of Tolu is the concrete juice of a South American tree; and is believed to be got by making incisions into the bark, is generally imported in cocoa-nut shells, and is a yellowish red-brown resinous substance, having a sweet aromatic taste, and a peculiar fragrant odour. It is soluble in alcohol and volatile oils, and readily imparts its agreeable flavour to boiling water. It contains, according to Deville, benzoic acid, a substance isomeric with the essential oil of bitter almonds, another oily matter called *cinnameine*, a liquid hydro-carbon named *tolene*, and several resinous matters. (Gregory).

Balsam of Peru is very similar to Balsam of Tolu. It is usually met with as a thick, red-brown, liquid, having a warm, aromatic, bitter taste, and a balsamic odour. When dried up it leaves a resinous residue almost identical with balsam of Tolu. The composition of the two is very similar, the balsam of Peru containing, however, more oil but less resin.

Actions and Uses.—These two balsams are identical in their action. They resemble styrax, benzoin, and other balsams in their effects. They are thought to be mildly tonic, but are even less powerful than myrrh. Both are slightly stimulant, and exercise, it is believed, a special influence on the pulmonary mucous membrane, causing expectoration. They were once favourite remedies in catarrhal and pulmonary affections, and were also used empirically for the healing of wounds. They are now scarcely ever used, either internally or externally; but are still occasionally employed to communicate a pleasant flavour to disagreeably-tasted drugs, articles of perfumery, and fumigating pastilles.

BARLEY.

HORDEUM.

Nat. Ord.—Graminaceæ. *Sex. Syst.*—Triandria Digynia.

Barley is used as an article of food for most of the domesticated animals; and when stripped of its outer husk is also recognised by the pharmacopœias as *pearl barley*. When ground to meal it is used for making poultices and infusions. When moistened and exposed to a temperature of about 100°, it begins to germinate, and if the process of germination be arrested by drying, the altered barley is converted into *malt*—a sweet mucilaginous substance, which is more easily digested but less nutritive than barley, and is, like it, used for making poultices and mild laxative drinks. When a solution of malt is fermented, as in the preparation of beer, ales, or porter, there rises to the surface of the liquor a yellowish-brown frothy scum, known as *yeast*, which readily putrifies when moist, but when dry remains for a long time unchanged. It contains water, alcohol, carbonic, acetic, and mucic acids, potash and lime, a mucilaginous saccharine extract, with minute vegetable cells, which constitute, it is believed, its active principle. Yeast is not now used internally, but is frequently employed for making antiseptic and deodorising poultices, which may be conveniently prepared with bran or linseed meal, an equal weight of yeast, and a sufficiency of boiling water.

BELLADONNA.

Deadly Nightshade. Leaves of *Atropa Belladonna.*

Nat. Ord.—Solanaceæ. *Sex. Syst.*—Pentandria Monogynia.

Belladonna is found growing in most parts of the country, especially about old walls, edges of plantations, and ruinous shady places. It has a straight, round, hairy, annual stem, several feet in height; large, smooth, ovate, acuminated leaves, which are supported on short leaf stalks, and are of a sombre-green colour, and of a faint bitter taste; dark purple bell-shaped flowers; a brownish-black berried fruit, with a mawkish taste; and a fleshy, branching, perennial root. All parts of the plant are possessed of considerable activity, but the leaves, and occasionally the root, are the parts usually in request by the druggist. The leaves are collected in June or July, and carefully dried. They contain water, lignine, gum, gummy extractive matter, starch, albumen, colouring matter, and a colourless crystalline poisonous alkaloid called *atropia* or *atropine*, which exists combined with malic acid, and is said to constitute $\frac{1}{15,000}$th part of the leaves, and $\frac{1}{260}$th of the root. When pure it is in colourless silky crystals, which are devoid of odour, but have a nauseous bitter taste. It is volatile, sparingly soluble in water, but dissolves readily in alcohol, and possesses in a concentrated form all the properties of belladonna. Its composition, according to Liebig, is $C^{34}\ H^{23}\ N^{6}\ O$.

Actions and Uses.—Belladonna in large doses is a narcotico-acrid poison, but its irritant effects are seldom very violent or long continued. In small doses, it is anodyne and antispasmodic; and it causes in all doses, and by whatever channel it enters the body, dilatation of the pupil.

Like most other narcotics, it has less effect on herbivora and graminivora than on omnivora or carnivora. A horse is mentioned by Moiroud as having consumed upwards of six pounds of the leaves without any bad effects. A donkey ate a pound of the berries with equal impunity. Münch says that goats and sheep devour it with apparent satisfaction, and without any obvious harm. On the other hand, Hertwig has experimented on upwards of twenty horses, and has observed tolerably decided effects. He gave the dry pulverised herb in quantities varying from four to six ounces, with meal and water, in four separate doses, and within a period varying from four to eight hours. In four or five hours, and still more on the succeeding day, he observed dulness, langour, expansion of the pupils, an uneasy look, and a feverish mouth. The appetite was gone, and digestion impaired, gas being abundantly evolved in the stomach and intestines. The pulse numbered about 90, was small, hard, and scarcely perceptible. The breathing was short, quick, and accompanied by flapping of the nostrils. The sensibility was slightly diminished, but there was no appearance of drowsiness. In some of the cases there was much abdominal pain; in others, imperfect power of moving the hinder extremities; and in others, a fatal termination in from thirty to fifty hours after the exhibition of the first dose. In most of the cases the symptoms gradually retrograded, and after thirty-six or forty-eight hours the animals were perfectly well. From two to three ounces of the dried root acted on horses in a similar manner; and six ounces usually proved fatal. Hertwig considers that belladonna is rather more active in cattle than horses; and records that doses of the root varying from two to four ounces caused in cows violent symptoms lasting forty-eight hours, and that larger doses were dangerous. In dogs, from 30 to 50 grains of the dried herb or root caused, in from fifteen to thirty minutes, whining and continuous moaning. In thirty minutes the iris had contracted so much as to be quite out of view, and had also become insensible to the brightest light. Though sight was gone, hearing and sensibility remained unimpaired. Vomiting sometimes occurred, the nose got dry and hot, and the gait tottering from inability to move the hinder extremities. After some time the animals became rather drowsy. In from one to three hours the symptoms began to abate, but contraction and diminished irritability of the iris still remained, even after twenty-four hours. (Hertwig).

Half an ounce of the ordinary watery extract is fatal to dogs in about thirty hours, when given by the mouth; half that quantity in twenty-four hours when introduced into a wound; and even smaller doses than these are more speedily fatal when injected into the jugular vein. (Christison). In animals poisoned by belladonna, the blood remains fluid, and putrefaction sets in very early. The lungs, and sometimes also the brain and its membranes, are congested; but no inflammatory appearances can in general be detected. When excessive doses have been given, the best remedies are those prescribed in cases of poisoning by opium.

Belladonna is used for many of the same purposes as opium; and especially as a calmative and anti-spasmodic. It has been prescribed for all the domesticated animals in colic, acute and chronic rheumatism, and pneumonic affections; but usually without much benefit. It appears superior to all other remedies in removing the irritation and spasm of tetanus, and, when used along with active purgatives and quiet, has been very effectual in many of the cases of that intractable disease which have of late years been treated at the Edinburgh Veterinary College. Some practitioners use it in hydrophobia, epilepsy, and such other nervous diseases; but without much success. It is a valuable application for relieving painful and irritable tumours; and, in the form of an injection, for allaying irritation of the bladder or rectum, and counteracting spasmodic contractions of the uterus.

It possesses, in common with hyosciamus and stramonium, the power of contracting the iris, and so enlarging the pupil; and produces this effect whether it be applied round the eye or given internally. When used internally it causes more or less temporary impairment of vision, but seldom has any such injurious effect when applied locally. This peculiar action on the iris is usually apparent within an hour after the use of the medicine, but often in a much shorter time; generally continues several hours, especially when developed by giving the belladonna internally; and is believed by Müller and other physiologists to depend on temporary paralysis of the ciliary nerves. A remarkably increased sufferance of light and other stimuli accompany this paralysing effect on the muscular fibres of the iris. These actions of belladonna are of much practical utility in preventing or breaking up adhesions between the iris and lens; in expanding the pupil, and facilitating the discovery and examination of cataracts; and in performing operations on the eye.

Doses, etc.—The dose of the dried powdered leaves for horses and cattle is about ʒij.; for dogs, from grs. ij. to grs. v. The leaves, however, are seldom used in this crude state, but are generally made into an extract or tincture. The extract is very apt to vary in strength, and from exposure to undue heat, is sometimes quite useless. An active preparation may, however, be made by the following process:—

"Take of belladonna fresh, any convenient quantity; bruise it in a marble mortar into a uniform pulp; express the juice; moisten the residuum with water, and express again. Unite the expressed fluids, filter them, and evaporate the filtered liquid in the vapour bath to the consistence of firm extract, stirring constantly towards the close."—(Ed. Phar.)

A tincture may be conveniently made with ten ounces of the bruised leaves, and a pint and a half of rectified spirit, flavoured with tincture of cardamoms. It may be got by digestion, or in the same way as tincture of hemlock. *Atropia* is sometimes used, but on account of its activity, must be employed with caution. The dose for the horse is gr. i. or grs. ij.; and for the dog, about gr. $\frac{1}{20}$. A solution made with grs. ij. of atropia, f℥i. of water, and a few drops of acetic acid, is much used in medical practice for developing the peculiar action of belladonna on the iris. A single drop of this solution, applied to the conjunctiva, produces the desired effect in a few minutes.

BENZOIN.

Gum Benjamin. Benzoinum. Concrete balsamic exudation of *Styrax Benzoin*. (Ed. Phar.)

Nat. Ord.—Styraceæ (Lindley). *Sex. Syst.*—Decandria Monogynia.

Benzoin is a concrete balsamic exudation yielded by a tree growing in the Islands of Borneo and Sumatra. When incisions are made through the bark, the juice exudes, concreting in tears, which are subsequently made into larger masses. These are red-brown externally, and yellowish-white within, are brittle, and easily pulverised, slightly heavier than water, of a sweet resinous taste, and an agreeable balsamic odour, which is much increased when the masses are rubbed or burned. Benzoin is dissolved by alcohol, alkalies, and acids, but is only partially soluble in water. When of inferior quality, it is dark-brown or nearly black, and devoid of amigdaloid structure. Besides traces of volatile oil, moisture, and impurities, it contains about eighty per cent. of resin, and nearly twenty of benzoic acid, which is exceedingly irritant, especially in vapour, and may be prepared either by subliming benzoin, or decomposing an alkaline solution of it.

Actions and Uses.—Benzoin is a mild stimulant. It was once in high repute as a remedy for coughs, all kinds of pectoral complaints, and consumption; but is now scarcely ever used internally. Some practitioners, however, still apply it externally in the treatment of contusions and wounds, generally making use of the Friars' Balsam, or of its pharmaceutical imitation, the *compound tincture of benzoin,* which is thus prepared :—

"Take of Benzoin, in coarse powder, four ounces; Peru balsam, two ounces and a half; East Indian aloes, half an ounce; rectified spirit, two pints. Digest for seven days, pour off the clear liquor and filter it."—(Ed. Phar.)

BRAN.

Husk of Wheat.

Nat. Ord.—Graminaceæ. *Sex. Syst.*—Triandria Digynia.

Bran is the name usually applied to the husk of wheat. It consists chiefly of lignine, with a little starch and gluten; and is often used as an article of diet, especially for sick animals.

It is not, however, very nutritive, and is generally purchased at a much higher price than it is really worth. Its chief medicinal use is in the making of poultices.

BUCKTHORN.

RHAMNUS. Fruit of the *Rhamnus Catharticus*. (Ed. Phar.)

Nat. Ord.—Rhamnaceæ. *Sex. Syst.*—Pentandria Monogynia.

Buckthorn is a shrubby, thorny-looking tree, which reaches eight or ten feet in height, and grows in the woods in most parts of the country. The berries, which are the only officinal part, are black, globular, about the size of peas, and contain an acrid, bitter, nauseous juice, which is at first green, but soon becomes red from the production of acetic acid. This juice is usually clarified; and, to remove its nauseous and irritating effects, boiled with sugar or treacle, and flavoured with ginger or other spices. Its active principle is unknown. The syrup, the only form in which buckthorn is used medicinally, is thus prepared:—

"Take of the fresh juice of buckthorn-berries, four pints; ginger sliced, and pimento bruised, of each six drachms; pure sugar, four pounds. Let the juice rest three days; pour off the clear liquor, and strain it. Digest the pimento and ginger in a pint of the strained liquor at a gentle heat for four hours, and filter. Boil down the rest of the juice to a pint and a half; mix the two liquors; add the sugar, and dissolve it with heat."—(Ed. and Lond. Phars.)

Actions and Uses.—Syrup of buckthorn is a cathartic; but so mild as to be useless either for horses or cattle. Even in dogs or cats its effects are not powerful, and its use is chiefly confined to young or delicate animals, and to cases of distemper. The dose for the dog is about f℥i., and for the cat about fʒiv.

CAJEPUT OIL.

Cajuputi Oleum. Volatile oil of the leaves of *Melaleuca minor*. (Ed. Phar.)

Nat. Ord.—Myrtaceæ. *Sex. Syst.*—Polyadelphia Icosandria.

Cajuput oil is the produce of a small crooked myrtaceous tree inhabiting the Spice Islands. It is prepared from the leaves by distillation, is transparent, of a greenish tint, and has an odour and taste somewhat resembling both cardamoms and camphor. It is soluble in alcohol, and its density varies from 914 to 927. The purity of the oil is best tested by its being entirely consumed by combustion. It is a diffusible stimulant, promptly raising the vital energies, and allaying spasm. It has been given in the human subject in various nervous diseases—in colic, cholera, and rheumatism; but is seldom used in veterinary practice, except as a stimulant application for strains, and chronic enlargements.

CALCIUM AND ITS MEDICINAL COMPOUNDS.

Lime. Quicklime, Oxide of Calcium. Calx. CaO.

When limestone or carbonate of lime (Ca O, Co^2) is burned, its carbonic acid is driven off, and the metallic oxide (Ca O) or quick lime is left. It is a greyish-white powder, with an astringent alkaline, caustic taste; and a great power of absorbing water, with which it forms *slaked lime*, a hydrated oxide (Ca O, HO.) Lime is soluble in 700 parts of cold, and 1200 of boiling, water. The solution known as *lime water* is prepared by slaking a small quantity of freshly burned lime, agitating it briskly with a large quantity of water, allowing the undissolved matter to subside, and pouring off the clear solution. It is a colourless fluid, has an alkaline taste and reaction, and unites with oils to form soaps. As it is apt to absorb carbonic acid, it should be kept in closely stoppered bottles. Lime and its compounds are readily detectible in solution by their yielding no precipitate with sulphuretted hydrogen or hydro-sulphuret of ammonia, but white precipitates with carbonic and oxalic acids, and the soluble salts of these acids.

Actions and Uses.—Lime is irritant, corrosive, desicant, and antacid.

Its irritant and corrosive properties depend on its affinity for water and its solvent action on the soft animal tissues. They speedily succeed the application of the powder to any of the mucous surfaces or to the skin. Orfila mentions that a drachm and a half administered to a little dog, caused vomiting, and considerable irritation, which lasted for about a day; and that three drachms caused vomiting, pain, languor, and death in five days. Lime resembles the alkalies in many of its actions, but differs from them in diminishing rather than increasing secretion. In this respect it is somewhat analogous to preparations of zinc and alumina; but its desicant action is mechanical, and unaccompanied by any true astringency. It is used as an antacid in indigestion, diarrhœa, and hoven, especially among cattle; and occasionally as an antidote in poisoning by arsenic and the mineral acids. It is applied externally for many of the purposes of a desicant; and in the form of lime water, mixed with an equal quantity of linseed oil, is used under the name of *Carron oil* (so called from the extensive iron-works of that name in Stirlingshire) in the treatment of scalds and burns. In such cases, however, the present approved mode of cure consists in immediately protecting the parts from air and moisture by layers of raw cotton, applied with gentle and equable pressure. It is often used both in powder and solution for cleansing and deodorising foul stables and byres.

Doses, etc.—The dose of quick-lime for horses or cattle is ʒi. or ʒij.; and for dogs grs. v. to grs. x. The dose of lime water for the former is f℥iv. or f℥v.; and for the latter from fʒi. to fʒiv. The lime water may be given alone, or as in the human subject with milk.

Carbonate of Lime. Chalk. Calcis Carbonas. $Ca\ O, CO^2$.

Carbonate of lime occurs in the several forms of calcareous spar, limestone, marble, and chalk. The last, the only variety of much medical importance, abounds in the south of England in beds mixed with silica, alumina, and oxide of iron. These impurities are removed by triturating it with a little water, agitating it with a larger quantity of water, allowing the coarser fragments and foreign matters to subside, and pouring off the clear liquid, which slowly deposits a fine impalpable powder, which, when dried, constitutes prepared *chalk*, the *creta preparata* of the pharmacopœia. Its properties are so familiar as scarcely to require description. It is of a dull white colour and earthy appearance, is tasteless, and adheres to the tongue owing to its affinity for water. It requires for solution about 1600 times its own weight of water, and its solubility is increased by the presence of carbonic acid.

Actions and Uses.—Chalk is the cheapest and most convenient of antacids; and is much used amongst all the domesticated animals in the treatment of indigestion, chronic diarrhœa, and dysentery. In such cases it proves effectual by neutralising the acid matters which cause or keep up the complaint, by absorbing irritant substances, and by protecting the intestinal surfaces. It is a good antidote for oxalic and the mineral acids. In a dry and finely divided state, it is used as a desicant for external wounds, absorbing their irritating discharges, and protecting them from the action of the air.

Doses, etc.—The dose for horses is from ℥i. to ℥ij.; for cattle, ℥ij. to ℥iv.; for sheep ʒij. to ʒiv.; and for dogs, grs. viij. to grs. xij. It is conveniently given in milk, gruel, or mucilage, and is frequently conjoined with catechu and other vegetable astringents; with ginger and other carminatives, as in indigestion and diarrhœa; and with opium or belladonna where there is much irritability or pain. When administered in large or frequent doses, the bowels should be kept open, so as to prevent its accumulation in the intestines.

CHLORIDE OF LIME. Bleaching Powder. Chlorinated Lime. Hypochlorite of Lime. Calx Chlorinata.

Large quantities of this valuable bleaching agent are made in Glasgow, where it was first prepared by Messrs Tennant and Mackintosh, in 1798. The process adopted is as follows:—Chlorine gas (produced by the action of sulphuric acid on common salt and black oxide of manganese) is transmitted into close chambers, where slaked lime, moistened with water, is spread on piles of wooden trays. The changes occurring are not well understood; but the lime, after being exposed to the gas for about four days, is found to have absorbed from thirty to forty per cent. of it, and has become the familiar bleaching powder.

Properties.—It is a soft, greyish-white powder, with a feeble odour of chlorine, or rather of hypochlorous acid, and an astringent, acrid, bitter taste. When exposed to the air it deliquesces, absorbs oxygen, and evolves hypochlorous acid. When heated it gives off chlorine, and afterwards oxygen gas. It is only partially soluble in water, for a part of the lime remains undissolved. The watery solution is colourless, or of a faint yellow tint, and has at first an alkaline, and subsequently a bleaching, action on vegetable colouring matters. This bleaching action is especially rapid on the addition of an acid. The exact composition of the substance is still undetermined, but the majority of chemists now regard it as a mixture or compound of hypochlorite of lime, and chloride of calcium. Its ordinary name of chloride of lime is therefore not strictly accurate.

Impurities.—From careless preparation or bad keeping, bleaching powder is apt to be of inferior quality. Many different methods have been proposed for ascertaining its strength and purity. The intensity of its odour, and the degree of its solubility, are simple approximative tests; but the most accurate is the amount of chlorine evolved by the addition of an acid. One hundred grains of a good specimen should yield from thirty to forty cubic inches of gas.

Actions and Uses.—Chloride of lime is irritant, stimulant, and astringent; and is besides used as an antiseptic, deodoriser, and disinfectant.

Its irritant, stimulant, and astringent properties, occur when it is applied to any mucous surface, either in powder or strong solution, and depend in part on the free lime it contains. Hertwig states that he has given it in variable doses to all the domesticated animals; to horses and cattle in from one ounce to two pounds; to sheep and goats in from one to eight drachms; and among dogs, from half a drachm to four drachms. The smaller quantities produced scarcely any effect; the larger quantities caused acceleration of the pulse, difficult breathing, increased warmth in the mouth, weeping eyes, an abundant secretion of urine, having a curious odour of chlorine or prussic acid, and a white sediment, frequent copious feculent discharges, and in dogs vomiting. In horses the effects usually began in about twenty or thirty minutes, and lasted from two to five hours. Considerable doses, when given repeatedly, did not impair the appetite, but caused thirst and gradual emaciation. It is seldom used internally. The late Mr Youatt recommended it as a remedy for hoven in cattle, and tympanitis in horses, in doses varying from two to four drachms, and ingeniously ascribed its supposed good effects to its decomposing the gases evolved in the alimentary canal. But from repeated and careful trials made at the Edinburgh Veterinary College, the conclusion has been arrived at, that it is of little if any service in the majority of cases of hoven or tympanitis, whether in cattle or horses. Some practitioners have thought it possessed of deobstruent virtues; but this has not been sufficiently proved. It is a valuable stimulant, antiseptic, and deodoriser for unhealthy ulcers, fistulæ, thrush, canker, and grease; is often effectual in curing mange and other skin diseases, attended by scurfiness and itching, and is recommended in diluted solutions for checking conjunctival opthalmia, and other circumscribed and superficial inflammations.

It is used to arrest putrefaction, and to destroy the fetid odours of gangrenous wounds, unhealthy excretions, and all kinds of decomposing animal matter.

From its undoubted efficacy as an antiseptic and deodoriser, it is naturally inferred to be a disinfectant. In houses where contagious diseases have prevailed, it should be spread in powder over the floor, and applied in solution to the walls.—(See Disinfectants, p. 15.)

CAMPHOR.

A peculiar concretion, from *Camphora Officinarum.* $C^{10} H^{8} O$.

Nat. Ord.—Lauraceæ. *Sex. Syst.*—Enneandria Monogynia.

The *Camphora Officinarum*, or *Laurus Camphora*, is a tall handsome evergreen, cultivated in Japan and China, and in many European conservatories. Its wood and leaves evolve a camphoraceous odour when bruised. From some experiments made by Professor Christison, it probably yields about 1-500th of its weight of camphor, which is extracted by exposing the wood to dry distillation; or, according to some, by boiling it with water. The camphor which distils over is condensed in cones lined with straw; the masses are broken down and sublimed; and, on their importation to this country, are subjected to a similar purification.

Properties.—Camphor occurs in concavo-convex masses, which derive their form from the vessels into which they have been sublimed. It is white, translucent, and crystalline, with a bitter pungent cooling taste, and a strong peculiar aromatic odour. It floats on water, and has a density varying from 985 to 996. When exposed to the air it slowly evaporates; and when heated takes fire, and burns with a sooty flame. It is tough and difficult to powder, unless with the addition of a little spirit. It dissolves readily in ethers, acids, and oils, in about its own weight of alcohol, in eight times its weight of milk, and in 1000 times its weight of water. It is considered to be an oxide of camphine or camphogen ($C^{10} H^{8}$)—a radicle which is also present in oil of turpentine, and various other organic substances.

The substance known as *Borneo camphor*, from its being obtained in the island of that name, is found in minute crystals in cavities in the wood of the *Dryobalanops Camphora*, and is distinguished from true camphor by its softness and friability, its high density, and its alliaceous odour. It consists of ninety-four per cent. of a colourless mobile volatile oil, and six per cent. of resinous matter. (Christison).

Actions and Uses.—Camphor, in excessive doses, is irritant and narcotic; and, in medicinal doses, slightly stimulant, sedative, calmative, and antispasmodic. It is somewhat irregular in its poisonous action. When given in the form of coarse powder, it acts chiefly topically, causing inflammation and ulceration of the alimentary canal; but when finely powdered, or in solution, it is absorbed, inducing derangement and depression of the nervous centres, with symptoms of giddiness, delirium, convulsions, and stupor. Moiroud states that doses of two ounces produced in horses convulsive movements, and acceleration of the pulse, unaccompanied, however, by any fatal results. Hertwig mentions that when doses varying from two to four ounces are given to horses and cattle, two to four drachms to sheep, or one to three drachms to dogs, the respiration and pulsation are accelerated, the breath acquires a camphoraceous odour, the sensibility appears to be heightened, and convulsions supervene. In dogs there is also imperfect power of controlling the movements of the limbs; and when the doses amount to three or four drachms insensibility and death ensue. The vapour of camphor is speedily destructive to frogs and insects, inducing difficulty of breathing, trembling, stupor, and death.

All parts of the bodies of animals poisoned by camphor evolve a strong odour of the drug. When the doses have been in the solid form, the stomach and intestines exhibit inflammation, and sometimes spots of ulceration. When camphor has been given in solution, besides vascularity of the alimentary mucous surface, the membranes of the brain are much injected, the pelvic viscera inflamed, and the heart filled with florid blood, indicating death from syncope.

In medicinal doses, camphor exercises a slight stimulant action, speedily succeeded by a depressing and calmative effect, which is of service in allaying nervous irritability. It is chiefly used in chronic cough, and other sorts of pulmonary irritation, in spasmodic diseases, and in typhoid fevers; and in such cases is especially useful when conjoined with opium and stimulants. It appears to be excreted chiefly by the mucous membranes and the skin; and, like other stimulants, exalts the activity of the excreting organs. Occasionally also it is in part removed by the kidneys, and hence sometimes produces diuresis. Various other properties have been ascribed to camphor, many of them on very insufficient grounds. It has been thought to possess the power of repelling the secretion of milk in women and animals that carried fragments of it about with them; has been frequently lauded as an anthelmintic; and has even been considered capable of arresting the propagation of contagious diseases. Some veterinarians combine it with cantharides, under the impression that it lessens the irritant action which that substance has on the kidneys. It is sometimes used externally to allay the irritation of skin diseases, painful ulcerations, articular rheumatism, as well as chilblains in man.

Doses, etc.—The dose for horses and cattle is from ʒi. to ʒiv.; and for dogs, from grs. iij. to grs. x. As it is required for the development of calmative, and not of irritant effects, it should be given made into an emulsion with eggs, or dissolved in milk or oil. For external use, it may be conveniently dissolved in six or eight parts of alcohol, in acetic acid, linseed oil, or oil of turpentine.

CANTHARIDES.

Blistering or Spanish Fly. Lytta Vesicatoria. Cantharis Vesicatoria.

Class.—Insecta. *Order.*—Coleoptera.

Cantharides flies are found in most parts of Southern Europe, Germany, and Russia, and occasionally along the south coast of

England. They settle in large numbers on certain trees and shrubs, as the lilac, ash, rose, honeysuckle, and privet. They are collected in May and June, by men who, with their faces protected by masks and their hands by gloves, sally forth after night-fall or before dawn to the shrubberies frequented by the insects, and shake the trees on which they feed. They fall in numbers, and are received in towels or sheets placed under and about the trees, are turned into sieves, and killed by exposure to the fumes of boiling vinegar or oil of turpentine, or by being placed in a vessel exhausted of air. They are then quickly dried, either in the sun or by exposure to artificial heat. At one time most of the flies used in this country were brought from Spain (and hence their vernacular name of Spanish flies), but they are now chiefly imported from St Petersburgh and Messina. They are usually packed in barrels or cases containing from 100 to 200 lbs.

Properties.—The insect measures from six to ten lines in length, and weighs about one grain and a half. It has a little furrow running along the head, neck, and body, and dividing the animal into two symmetrical halves; a pair of fine, gauze-like, membranous wings; and investing these a pair of shining wing coverings, called *elytræ*, which are of a green or greenish-yellow colour, and so indestructible that they have been recognised by Orfila in the human stomach nine months after interment. The body, especially along its under surface, is covered with greyish-white hairs; the head is large; the antennæ or horns are black, and thread like, and project beyond the head. The insect is said to live from eight to ten days. It deposits its larvæ in the earth, leaving them to be hatched by the heat of the sun. Cantharides has a resinous acrid taste, and a disagreeable penetrating fœtid odour, which is especially strong while the animal is alive. When powdered, it is freely soluble in boiling water, alcohol of all strengths, acetic acid, and fixed and volatile oils. The active principle is volatile, and hence no cantharidine preparation should be heated beyond 212°. When exposed to moisture, cantharides becomes spoilt, and should therefore be kept in tightly fitting drawers lined with paper, or in closely stoppered bottles. The vesicant action of the cantharides, and the brilliant green appearance of the wing coverings are the best tests by which it can be identified.

Cantharides, as recently analysed by Robiquet, consists of:—

A green fluid fatty oil, probably giving colours to the elytræ, but devoid of any vesicant effect; a bland yellow viscous matter, soluble in water and alcohol, and also without vesicant action; a black matter, soluble in water, insoluble in alcohol, and also without vesicant action; a principle resembling ozmazone; acetic and lithic acids, with phosphates of lime and magnesia derived from the osseous structure of the animal; and an acrid, volatile, crystalline principle, of a white micaceous appearance, possessing most energetic vesicant properties, and called *cantharidin*. It appears to be confined to the soft parts of the body of the insect, and does not exist in the head, wings, or limbs. The posterior parts of the body, particularly the sexual organs, and especially those of the female, contain the largest amount of this principle. It may be prepared by concentrating the tincture, from which it slowly crystallizes; and may be afterwards purified by washing with alcohol, and boiling with animal charcoal. When pure it is insoluble in water, but soluble in alcohol, acetic acid, ether, chloroform, and oils. It appears to be a solid volatile oil, and consists of $C^{10} H^6 O^4$. A principle exactly similar to cantharidin is found in the bodies of most other insects, which cause vesication when rubbed into the skin.

Impurities.—In this country cantharides may generally be obtained tolerably pure. The flies should be purchased entire, as the powdered cantharides sold in the shops sometimes contains euphorbium and various other substances. Attention to the characteristics of the cantharides fly will at once lead to the detection of adulteration by admixture of other insects. The causes which most seriously interfere with the efficacy of the blistering fly are long keeping, and the attacks of mites, moths, and other parasites. The most effectual way of preserving cantharides from such attacks is to keep them in closely stoppered bottles, with a few drops of acetic acid, or a few grains of camphor, or carbonate of ammonia.

Actions and Uses.—Cantharides when given internally is an irritant, general stimulant, and diuretic; and when applied externally, a rubefacient and vesicant.

When given in large doses, it acts in all animals as a powerful poison, causing intense gastro-enteritis, inflammation of the bladder, and frequently coma, convulsions, and death. According to Orfila, cantharides causes violent inflammation of any part with which it comes in contact, and seems also in these excessive doses to exercise a powerful influence on the nervous system, and especially on the spinal chord. He found that in a dog "three drachms of the tincture, with eight grains of powder suspended in it, caused death in twenty-four hours, if retained in the stomach by a ligature on the gullet, insensibility being the chief symptom; and that forty grains of the powder killed another dog in four hours and a half, although he was allowed to vomit. In all the instances in which it was administered by the stomach, that organ was found much inflamed after death; and generally fragments of the poison were discernible if it was given in the form of powder. When applied to a wound, the powder excites surrounding inflammation; and a drachm will in this way prove fatal in thirty-two hours, without any constitutional symptom except languor." (Christison on Poisons, pp. 609-10). An ounce administered to a horse caused death in eighteen hours; and fatal effects are reported to have occurred where only one drachm was given. (Morton).

In cases of poisoning by cantharides the post-mortem appearances are congestion and inflammation of the alimentary canal and urinary apparatus, the latter being usually most affected when the animal survives some days after the administration of the poison. In most cases there is congestion of the brain, and effusion into its cavities.

When cantharides has been given in an excessive dose, or has caused undue irritation of the urinary organs from being absorbed from the surface of the skin, mucilaginous substances should be given in large quantity, both by the mouth and rectum, and in the horse fresh sheep skins should be laid over the loins. When the pain and inflammation are great, blood-letting followed by opiates may be necessary.

In small and repeated doses, cantharides is a stimulating tonic; but its use requires caution, as it is very apt to produce diuresis, and occasionally much irritation of the urino-genital organs. When given for some time continuously, little vesicles usually appear on the skin. It is currently believed to possess the power of stimulating the sexual appetites, but this action only occurs where it is given in poisonous doses. It is seldom used internally. The chief cases in which it has been given are weakness and impaired action of the digestive and urinary organs. In man it is sometimes useful in relieving dropsies, and arresting chronic mucous discharges.

Cantharides, when applied to the skin of animals, causes first irritation, pain, and swelling, with some redness; and by and bye effusion of serum in circumscribed spots betwixt the true skin and the epidermis, constituting vesicles or blisters. These usually appear in from three to twelve hours, according to the strength of the preparation and the state of the part to which it is applied. They vary much in size, and, after a variable but usually short time, they burst, discharging a yellow serous fluid, which soon becomes sticky and pus-like, and dries into a scurfy cicatrix. In a fortnight or three weeks the blistered part is usually healed, and all mark nearly obliterated. Sometimes, however, when the inflammation has affected the deep-seated tissues of the skin, the hair is removed, and does not readily grow again. This most commonly results from the excessive strength of the preparation, from its containing corrosive mineral substances, or from the injudicious application of blisters to parts in a state of undue irritability. The blistering action of cantharides differs somewhat in the different domesticated animals, being most powerful in horses, rather weaker in sheep and dogs, and still more so in cattle and swine. It is more prompt and efficient in young, well bred, and thin skinned animals, than in old, coarsely bred, and hard hided subjects. When applied to wounds, ulcers, or parts in a state of acute inflammation, it causes excessive irritation, and sometimes extensive sloughing. But, on the other hand, when there is much vital depression or active inflammation near the blistered part, the action of the cantharides is slow and imperfect. Cantharides possesses several characters which distinguish it from other vesicants: it acts slowly and gradually, but its effects continue for a long time; it causes an unusual amount of serous effusion, but seldom, when used judiciously, produces any untoward results; and it is occasionally absorbed, causing diuresis and other constitutional effects, which occur especially when it is applied in large quantity over an extensive surface, when the skin has been abraded, or when the local action is slow and imperfect.

There is no vesicant more extensively employed than cantharides. Acting beneficially by abstracting blood and nervous influence from inflamed parts, it is used among the different domesticated animals as a counter-irritant in inflammation of all the internal organs, except the kidneys and bladder. Like all other vesicants, it is most effectual after the more acute inflammation has been subdued: indeed, whilst inflammation is at its height, blisters, if they act at all, often do more harm than good. Cantharidine applications being especially useful in chronic and sub-acute inflammation, are in consequence more effectual in the internal diseases of cattle than of horses. They are often serviceable in rheumatic affections, particularly those of long standing. They are frequently prescribed in cases of paralysis and tetanus, being in the latter disease usually rubbed in all the way along the spine from the occiput to the tail. Such a mode of application is, however, exceedingly injurious, and is directly contra-indicated by the nature of the disease, which, to be treated successfully, requires soothing remedies and quiet. They are largely used as stimulants and vesicants in inflammation and swelling of joints, bursæ, ligaments, tendons, and bones; and in such cases act beneficially by inducing an increased activity in the circulation of the parts, a greater activity of absorption, or a transference of irritation or inflammation from deep-seated parts of the skin. In small quantity, they are often used to promote adhesion of old and unhealthy wounds and fistulæ, to improve the quality of vicious pus, and to induce a more healthy state of the skin, as in mallenders, ring-worm, and sometimes in inveterate mange. In using cantharides as a blister, care must be taken not to apply it to any part in a state of highly exalted vascularity and sensibility, as during active inflammation. The tendency of cantharides to become absorbed and stimulate the urinary organs must also be borne in mind, and its use avoided in all cases in which these organs are in a morbidly irritable state.

Doses, etc.—The dose of cantharides for horses is grs. iv. to grs. xx.; for cattle, ℈i. to ℈ij.; for sheep and swine, grs. ij. to grs. viij.; and for dogs, gr. ½ to grs. iij. These doses should be repeated once or twice a day, care being taken to watch their effects, and to suspend their administration should any untoward effects occur. They are usually given in the form of a bolus, with aromatics and bitters; and occasionally in that of a tincture.

Cantharides is used externally in many different forms, but chiefly in those of a powder, tincture, ointment, liniment, or plaster.

Powdered Cantharides, which should be carefully preserved from moisture, is principally used for keeping up discharges, and for scattering over mustard poultices and other stimulant applications to increase their activity.

Tinctures of Cantharides, vulgarly termed sweating blisters, may be made of any strength. Those used in human medicine are too weak for most veterinary purposes. One part of powdered flies to fifteen or twenty of proof spirit forms a useful tincture of medium strength. This may be prepared by digestion for several days, or more speedily by percolation. Some practitioners augment the activity of such preparations by the addition of a small quantity of euphorbium, liquor ammoniæ, or oil of turpentine. The tinctures of cantharides in common use act more speedily than the ointments, but their effects are less powerful, and of shorter duration. Though they produce considerable irritation, they seldom cause blistering, unless used repeatedly at short intervals. In using them, it is not essential that the hair be removed, nor even that the animal be kept idle. They may be applied repeatedly to the same spot without fear of blemishing.

Acetum Cantharidis, a solution of flies in acetic acid, is often used in human medicine, and is equally applicable to veterinary practice. One part of powdered cantharides to ten or twelve of commercial pyroligneous acid forms a prompt and powerful counter-irritant.

Ointments of Cantharides are much used in veterinary practice, as their oleaginous constituents render them easy of application, and ensure their efficiency by dissolving the active principles of the fly. There is scarcely any limit to their number and variety. Many of them contain a great number of ingredients, but the simplest are usually the best. A useful ointment of medium strength consists of one part of powdered cantharides to four or five of hog's lard, resinous ointment, or such other excipient. Such an ointment, when well made and applied with smart friction, acts very efficiently, is little apt to blemish, and hence is preferable to more complex preparations. The following prescription is also a good one :—

Powdered cantharides, one part; Venice turpentine, one part; resin, one part; palm oil or lard, three parts.

Amongst the many irritant substances which needlessly enter into the composition of the blistering ointments of the shops, are euphorbium, sulphuric acid, and occasionally even corrosive sublimate and arsenic. The two former of these are present in the following common preparation :—

Powdered cantharides, one ounce; powdered euphorbium, one ounce; oil of thyme, two drachms; sulphuric acid, two drachms; resinous ointment, four ounces.

For horses such a preparation must be used with much caution, for besides enough of cantharides alone to render it an active blister, it contains a very unwarrantable amount of euphorbium and sulphuric acid, each of which ingredients, if used at all, should never exceed in quantity one-eighth part of the active principles of a blister. In larger amount they are very apt to cause unnecessary pain, sloughing of the integuments, and permanent blemishing. In preparing cantharidine ointments the oleaginous and resinous substances are melted together over a slow fire, and when liquified are removed from the heat, and the powdered cantharides stirred in, along with euphorbium and the volatile oils. The stirring should be continued until the mixture has acquired a proper consistence. To ensure the full vesicant effect of cantharidine ointments, the hair should be removed from the part to which they are to be applied. The skin should also be washed with soap and water, and subjected to hot fomentations or smart friction. The ointment should then be spread over the part, and well rubbed in. The size of the surface to be covered must depend of course upon the nature, seat, and extent of the malady. Where the ointment is too liberally applied, it sometimes spreads beyond the desired limits; this, however, may be easily prevented by surrounding the blistered spot with an edging of resinous ointment. While rising, the blister causes much irritation, and the animal, if permitted, will rub or bite the blistered part. In the horse, this should be prevented by tying the head to the rack, or putting on the beads; in the dog, by the use of the muzzle. The day after the blister has been applied, the part should be fomented with warm water, and dressed with oil, lard, or any simple ointment; but if a sufficiently powerful effect has not been produced, a little more of the blister may be applied.

Liniments of Cantharides are merely liquified ointments, and in respect of activity occupy a mediate place between ointments and tinctures. They generally consist of one part of cantharides, and six or ten parts of linseed oil. Oil of turpentine is sometimes also added. Many practitioners use a liniment of one part of cantharides and four of tar—a preparation not very commendable and not easily rubbed in.

Plasters of Cantharides are not much used in veterinary practice, being difficult of application, and very apt to be displaced by the powerfully corrugating action of the paniculus carnosus. They are made in the same manner as ointments, but rendered more strongly adhesive by the addition of a large amount of resin or pitch. They are usually applied in the melted state, immediately surrounded by a little tow or teased lint, to prevent cracking, and enveloped in a woollen, cotton, or linen bandage.

CARAWAY.

CARUI. Fruit of the *Carum Carui*.—(Ed. Phar.)

Nat. Ord.—Umbelliferæ. *Sex. Syst.*—Pentandria Digynia.

The caraway plant is found in many quarters of the world, and is cultivated in various parts of England. The fruit, or seeds as they are popularly termed, are so familiar as scarcely to require description. They are of a brown colour, curved, and slightly ridged, with a pleasant aromatic odour, and a strong warm taste. Like the other aromatics of this natural family, they owe their properties to a volatile oil, of which they contain about four per cent. They are stomachic and carminative, resembling anise in their actions, uses, and doses. They are, however, too mild to be of much service in veterinary practice except in combination, and are chiefly used for flavouring purposes.

CARDAMOMS.

CARDAMOMUM. Capsular fruit of *Elettaria Cardamomum*, and of other allied genera.—(Pereira).

Nat. Ord.—Zingiberaceæ. *Sex. Syst.*—Monandria Monogynia.

The true, small, or officinal cardamoms are yielded by a herbaceous plant growing on the Malabar coast, and now called the *Elettaria C.* The capsular fruit is bluntly oval, triangular, from half an inch to an inch in size, tough, coriaceous, and of a light yellow colour. It contains a large number of red-brown seeds, which have a fragrant odour and a warm pungent taste, are easily pulverised, and yield their properties to water and alcohol. They contain 77·3 per cent. of woody fibre, a little starch, phosphate of lime, colouring matter, 10·4 of fixed oil, and 4·6 of a colourless, pungent, volatile oil, to which they owe their flavour and other properties.

Actions and Uses.—Cardamoms are mildly stimulant, stomachic, and carminative; and very similar to ginger in their actions, uses, and doses. They are chiefly employed to communicate an agreeable flavour to other medicines. Two preparations are in use—the simple tincture made with proof spirit, and the compound tincture containing in addition caraway seeds, cinnamon, raisins, and cochineal.

CASCARILLA.

Bark of *Croton Eleuteria*, and probably of other allied species.

Nat. Ord.—Euphorbiaceæ. *Sex. Syst.*—Monœcia Monadelphia.

Cascarilla bark is principally imported from the Bahama Islands in quilled pieces about the size of a pencil, and varying from two to four inches in length. Its structure is dense and brittle; its outer surface fissured, and usually covered with a light-coloured lichen; and its inner surface smooth and light brown. Its powder has the same colour, with a strong, pungent, but not disagreeable taste, and a peculiar aromatic odour, which is much increased by heat. From its fragrance it is frequently used as a constituent of fumigatory pastilles. Cascarilla bark, besides woody fibre, contains 15 per cent. of a bitter resin, 18·7 of a bitter gummy extract, 1·6 of a pungent volatile oil; and a small quantity of a neutral, odourless, bitter, non-azotized, crystalline body called *cascarilline*. The two latter constituents appear to be the active ingredients of the bark, and are soluble in spirit, and also, though less readily, in water.

Actions and Uses.—Cascarilla is a bitter tonic. It resembles cinchona in its general effects, but is considerably less active. Many practitioners use it for all the domesticated animals in indigestion, diarrhœa, chronic typhous affections, and convalescence from exhausting diseases. But for such cases, especially amongst horses and cattle, there are many more efficacious remedies.

Doses, etc.—The dose for horses and cattle is from ℥i. to ℥ij.; and for sheep and dogs, ʒi. to ʒiv. It is given in the form of bolus, decoction, or tincture.

CASTOR OIL.

RICINI OLEUM. Expressed Oil of the seeds of *Ricinus Communis*. —(Ed. Phar.)

Nat. Ord.—Euphorbiaceæ. *Sex. Syst.*—Monœcia Monadelphia.

The castor oil plant, or *palma christi*, is indigenous to various parts of the world, but its development varies in different countries and climates. When cultivated in the colder parts of Europe, it is an annual shrub about three or four feet high. In Spain and Sicily it reaches a height of about twenty feet, and in still more southern latitudes, as in India, central Africa, and various parts of North and South America, it becomes a large tree.

The officinal part of the tree are the seeds, three of which are contained in each capsule. They are about the size of haricots, of a yellowish-white colour, and mottled with red-brown spots. The investing coat, which forms about 24 per cent. of the whole seed, consists chiefly of lignine. The nucleus, comprising nearly 70 per cent. of the seed, contains 46·2 per cent. of a fixed oil—the castor oil—associated with 21 per cent. of albumen, 2·4 of gum, and, according to some, a small quantity of an acrid purgative principle, which remains after the expression of the oil. The seeds farther contain about 8 per cent. of moisture.

Castor-oil, besides being manufactured in London, is largely imported from the East Indies, and America, and occasionally in small quantities from the West Indies and Australia. Various modes are adopted for extracting and purifying the different varieties of castor-oil. It is manufactured in London by crushing the seeds in a screw or hydraulic press, purifying the oil by rest and filtration, and bleaching it by exposure on the house-tops to sun and light: in the East Indies by expressing the oil as above, heating it with boiling water, and then straining it through flannel: in America by heating the seeds,expressing, and then boiling the oil with water: and in Jamaica by boiling the bruised seeds with water, and skimming off the oil as it rises to the surface—a process which, however, yields a very inferior and dark-coloured oil. In various parts of continental Europe the oil is prepared by the agency of alcohol, but this is an expensive and inconvenient plan. The oil obtained by these various methods differs slightly in its activity, but considerably in colour, flavour, solubility, and the property of keeping. That prepared without the application of heat, and known as cold-drawn castor-oil, is generally preferred, as, when a high temperature is employed, either in roasting the seeds or boiling the oil, the product is very acrid.

Properties.—Castor-oil has a yellow colour more or less dark according to quality, an unpleasant oily odour, and a disagreeable greasy taste. It is lighter than water, but is one of the heaviest of the fixed oils, its specific gravity at 60° being 964. When its temperature is reduced below 32°, it becomes dense and opalescent, and deposits a small quantity of margarine. No deposit, however, is obtained from oil which has been previously raised to the boiling point of water. When long exposed to the air, it becomes rancid; and if in a thin layer thickens, and after a time entirely dries up. It is soluble in hot and cold alcohol, and in ether, but not in water; is easily miscible with other oils; saponifies with alkalies; and, with one-twentieth of its weight of hyponitrous acid, is converted in about seven hours into a yellow substance termed *palmin.*

Much doubt still prevails as to the exact composition of castor-oil. It is believed to consist of glycerine (the sweet basic principle present in all oils and fats) united with two fatty acids, margaritic and ricinic acids—the former a crystallizable body, the latter a liquid. (Gregory). Soubeiran many years ago found in castor-oil a soft resinous oil to which he ascribed its purgative properties; but his researches have not been verified. From its belonging to the same natural family as croton, and from its having similar properties, it might naturally be expected that it should, like croton, contain an active, acrid, volatile acid; but as yet no such substance has been found in castor-oil. According to Saussure, its ultimate composition is 74·18 of carbon, 11·03 of hydrogen, and 14·79 of oxygen.

Impurities.—Castor-oil is seldom adulterated. The inferior sorts are distinguished by their dark colour, and disagreeable acrid taste and odour. This, when depending upon rancidity, may be removed by boiling the oil for fifteen minutes with water and calcined magnesia. The dark colour may also be removed by exposure to sun-light, and filtration through animal charcoal. "Pure Castor-oil is entirely dissolved in its own weight of alcohol."—(Ed. Phar).

Actions and Uses.—Castor-oil seeds are irritant and purgative; and have repeatedly caused fatal gastro-enteritis in man. They appear to be more powerfully irritant than the oil extracted from them.

The oil is a mild purgative, closely resembling linseed and the other fixed oils in its action. It causes increased activity of the bowels, but without the frequent and watery discharges induced by some cathartics. Its action seems to depend rather on its increasing the peristaltic motion, than the secretions of the intestines. After its administration it may usually be observed, in oily-looking flakes, amongst the dejections, giving them a glazed appearance. When injected into the veins of man it causes laxative effects, and produces in the mouth the same disagreeable oily taste, as when taken in the usual way.

In the horse, castor-oil, like other oleaginous substances, is not very certain or prompt in its effects, and is seldom to be recommended where a speedy or full purgative effect is desired. In cattle and sheep its action is more to be depended upon; but in these animals, especially in cattle, it is generally superseded by linseed oil, which is similar in its action, and less expensive. In the dog, however, few cathartics are more frequently used, or so deservedly held in high repute, as castor-oil. It is a safe and easy purge, and its only disadvantage is that it occasionally acts as an emetic. This is not the result of any specific emetic action, but depends merely upon the nauseous taste and oleaginous nature of the fluid, and in most cases may be entirely obviated by giving the oil with mucilage, a little spirit, or some aromatic, and making sure of its being free of all rancidity.

In properly regulated doses, it produces purgation without irritation or griping, and is hence exceedingly useful, especially in young animals, in irritation and inflammation of the digestive organs, as in dysentery, enteritis, and peritonitis; in hernia; advanced pregnancy; affections of the kidneys and bladder; and in all cases where more drastic purgatives might induce undue irritation. Its anthelmintic action has sometimes been overestimated, and is in reality very slight, and entirely dependent upon its purgative action. Castor-oil is unsuitable for external use on account of its great tendency to become rancid. It is sometimes employed as a clyster; but for our patients is in this respect also generally superseded by linseed-oil.

Doses, etc.—The castor-oil seeds might be conveniently given to the dog or pig in numbers of from 6 to 8, triturated with linseed meal, and made into a bolus, or rolled up in a piece of meat or such other food. The dose of castor-oil for the larger quadrupeds is about Ōi.; for sheep, f℥iij.; and for dogs, f℥i. to f℥ij. It is generally given alone, but sometimes mixed with gruel and aromatics. Its efficiency may often be conveniently increased by combining it with small quantities of oil of turpentine or of croton.

CATECHU.

Extract of wood of *Acacia Catechu;* of the kernels of *Areca Catechu;* and of the leaves of *Uncaria Gambir;* probably too from other plants.—(Ed. Phar.)

The Acacia Catechu belongs to the *Nat. Ord.*—Leguminosæ. *Sex. Syst.*—Monadelphia Polyandria.

Catechu, also called cutch, gambeer or terra japonica, is an extract prepared from the wood, leaves, or kernels of various species of catechu, and also of other plants. It derived its old name of terra japonica from its being imported from Japan, and from the opinion that it was an earth. Its more recent and correct name of catechu is more in accordance with its true nature, being derived from *cate*, a tree, and *chu*, juice. Mr Morton, in adopting the nomenclature and sources of catechu, as given by the London College, falls into the very common error of ascribing it to the wood of the acacia catechu alone; whereas it is now certain that the extract of catechu in common use, is obtained from various parts of the plant besides the wood, and is also derived from various other plants besides the one mentioned by the London College. There are at least three different plants which yield the catechus of commerce—the *Acacia Catechu*, an Indian shrub, twelve or fourteen feet high—the *Areca Catechu*, or betel-nut tree, a tall, beautiful palm, with large leaves, numerous flowers, and a thick, fibrous fruit, containing the betel-nut, which is an astringent seed about the size of a plum—and the *Uncaria Gambir*, a low shrub belonging to the natural family Rubiaceæ, and inhabiting the Islands of the Indian Archipelago. The processes followed for the extraction of the catechu from these different sources are very similar. The wood, leaves, or seeds are bruised and boiled with water; the liquor thus procured is concentrated; and when of sufficient consistence, is poured into moulds, usually made of clay.

Varieties.—Catechu is chiefly imported to this country from Bombay, Calcutta, and other parts of the Indian Peninsula. It varies much in appearance and quality; but the many different kinds used in tanning, dyeing, and medicine, are included under the three classes, brown, yellow, and grey catechus.

The Brown Catechu is of several kinds. The best occurs in round, irregular, and somewhat flattened masses, weighing from two to four ounces, and is known as *ball* catechu. Its surface is generally covered with the glaumes or husks of rice. Its fresh fracture is smooth, of a dark chocolate-brown colour, and occasionally marked with a red marbling. It has a strong astringent taste, followed by a sensation of sweetness, but without any bitterness. It communicates a red colour to the saliva. *Lump* catechu differs from ball catechu chiefly in form, being made into large masses weighing eighty pounds and upwards. Both these varieties are probably obtained from the wood of the *Acacia Catechu*. *Colombo* catechu has only recently found its way into British commerce. It is believed to be obtained from the *Areca Catechu.* It is in small, hard cakes, has a resinous, red-brown fracture, an astringent taste, and is of superior quality, some specimens containing 53 per cent. of tannin. (Christison).

The Yellow Catechus are distinguished from the other sorts by their greyish-yellow colour, their loose, brittle structure, lighter density, and duller fracture. When chewed, they communicate a yellow colour to the saliva. The most highly prized of the yellow catechus is the *dark gambeer*, which is imported from Singapore, and is believed to be prepared from the leaves of the *Uncaria Gambir*.

The Grey Catechus are of less importance than either the brown or the yellow. They are less astringent, more apt to be adulterated with starch and other impurities; and though used for tanning and dyeing, are rarely employed in medicine.

Properties.—All the catechus have an agreeable astringent taste, and leave, when chewed, an impression of sweetness. They have no odour. When heated, they soften, froth up, and char. They are soluble in alcohol and in water, and their solubility in the latter medium is a tolerably correct indication of their quality, for the inferior are considerably less soluble than the superior sorts. The infusion is generally prepared with hot water. When strong, it is slightly acid, and deposits a reddish substance as it cools. When diluted, it changes from red to yellow, is deepened in colour by alkalies, and precipitated by gelatine and salts of lead, copper, and peroxide of iron. As these metallic salts form insoluble compounds with catechu, they should not be given along with it. With chemical tests it comports itself in the same manner as any other tannin-containing substance.

Composition.—The composition of catechu has been investigated by many chemists; but the following analyses by Sir H. Davy are still considered the most trustworthy:—

	Dark Catechu.	Pale Catechu.
Tannin, . . .	54·5	48·5
Extractive matter, . .	34·0	36·5
Mucilage, . .	6·5	8·0
Insoluble residue, .	5·0	7·0

The proportion of tannin contained in the different sorts of catechu is very variable. The extremes, says Professor Christison, are probably 28 and 54 per cent. The extractive matter of Davy, also known as resinoid matter, catechine, or catechuic acid, is insoluble in cold, but soluble in hot, water; and is, when pure, a white, silky, crystalline powder, represented by the formula $C^{15}\ H^{6}\ O^{6}$.

Impurities.—Catechu is liable to various adulterations. Sand and other inorganic matters, which are the most common impurities, are readily discovered by chewing the specimen, which, when pure, should be free of grittiness; or by burning it, and observing the amount of residue. The best test, however, alike for the purity and goodness of catechu, is the proportion of tannin it contains.

Actions and Uses.—Catechu is astringent and antiseptic. Like other tannin-containing substances, it combines with the gelatine and albumen of the tissues, and so lessens their calibre, and renders them insoluble and capable of resisting putrefaction. On account of these properties, it is much used by the tanner in the preparation of tanno-gelatine or leather. Catechu is less astringent than oak-bark or galls, and is, therefore, more suitable for internal administration. It is given to all the domesticated animals in general atony and relaxation, and in excessive mucous discharges, especially from the alimentary canal. In such cases it is often advantageously combined with aromatics, to remove flatulence; with opium, to relieve irritability; and with magnesia or an alkali, to counteract acidity. It is used as an application for sluggish sores and ulcerations, for excoriations on the udder of cattle, and for all the ordinary purposes of a vegetable astringent.

Doses, etc.—The dose of catechu for horses is from ʒij. to ʒv.; for cattle, from ʒiij. to ʒviij.; for sheep and swine, from ʒi. to ʒiij.; and for dogs, from grs. x. to grs. xl. These doses may be administered three or four times a day, with a sufficiency of mucilage or gruel to cover their astringent taste.

The chief officinal preparations are the infusion and the tincture. The former may be readily prepared for veterinary purposes by pouring boiling water over any convenient quantity of catechu, allowing the mixture to stand by the fire for a few hours, and straining. Flavouring ingredients may be added if required. A good tincture of catechu may be easily made on the same principle as that of the Edinburgh College, which gives the following process:

"Take of catechu in moderately fine powder, three ounces and a half; cinnamon in fine powder, two ounces and a half; proof spirit, two pints; digest for seven days, strain and express strongly the residuum; filter the liquors. This tincture may also be prepared by the process of percolation, the mixed powders being put into the percolator without being previously moistened with the spirit."—(Ed. Phar).

For external purposes the powder or infusion is commonly used, and occasionally an ointment.

CHAMOMILE.

ANTHEMIS. Simple flowers of the *Anthemis nobilis.*—(Ed. Phar.)

Nat. Ord.—Compositæ. *Sex. Syst.*—Syngenesia, Polygamia superflua.

Chamomile flowers are extensively cultivated in the warmer parts of England; are gathered during dry weather; exposed for a short time on trays in a shady place; and are afterwards carefully stored, and kept very dry. Two sorts are met with in the shops—the single, or Scotch, and the double, or English.

The former is universally preferred, and is the only variety acknowledged by the Pharmacopœias.

Chamomile flowers have a hot, bitter taste, and a strong aromatic odour. They contain a bitter extractive matter, soluble both in water and alcohol; a small quantity of tannin, easily discoverable in the watery solution by its precipitation with gelatine or sesqui-chloride of iron; and a volatile oil, which, when first distilled, is of a beautiful blue colour, and is the chief active principle of the plant.

Actions and Uses.—Chamomile flowers are stomachic, carminative, and mildly tonic. Their stomachic and carminative virtues depend upon the volatile oil, and their tonic properties on the extractive matter and tannin. They are occasionally given to horses and cattle in doses of one to two ounces, as a domestic remedy in indigestion; and, in the form of fomentations and poultices, are sometimes used to remove external inflammations. For this purpose, however, they are scarcely, if at all, superior to linseed or oat-meal.

CHARCOAL.

Carbon. C.

Two varieties of charcoal are used in medicine and pharmacy, namely, wood charcoal, or *carbo ligni*, and animal charcoal, or *carbo animalis*. The former is prepared by piling some of the harder woods into heaps, covering them with turf and sand, and leaving a few apertures for the admission of air. The pile is then ignited; and, after the flame has risen through the whole mass, the openings are closed, and the combustion proceeds slowly without access of air. The moisture of the wood, its oxygen, hydrogen, and nitrogen, are dissipated, leaving carbon and mineral matters. The charcoal varies in composition with the wood from which it is prepared, but contains, on an average, about 87 per cent. of chemically pure carbon, 2 of ashes, and 11 of volatile matters. (Berthier).

Animal charcoal, also known as bone or ivory black, is chiefly prepared from bones, which are first boiled to separate fatty matters, and then heated in close vessels until vapours cease to be disengaged. The fixed residue contains carbon, with about ten times its weight of phosphate of lime (Graham), which exists in a state of very fine division, separates the particles of the charcoal from each other, and greatly enhances its value as an agent for the destruction either of colours or odours.

Vegetable and animal charcoal differ considerably in their characters. They are both of a brownish-black colour, are insoluble, inodorous, and tasteless. They readily absorb moisture, all the liquifiable gases, and most vegetable colouring matters. Animal charcoal, the more valuable of the two, may be distinguished by its density, its incombustibility, its bitter taste, and its containing a large proportion of phosphates.

Actions and Uses.—From its insolubility both in water and acids, charcoal has no physiological effects; and its few medicinal actions are dependant chiefly on its desicant, antiseptic, and deodorising properties. It is frequently given in chronic diarrhœa and dysentery, especially in cattle; and is very useful in these complaints in lessening the fœtor and acrimony of the feces. Although once much used as an anthelmintic, it is now superseded by more certain and potent remedies. It is still sometimes held to be an antidote for poisoning by arsenious acid, and, like other insoluble powders, appears to envelope the particles of the poison, and so prevent its effects. It is only effectual, however, when given promptly, and in cases when the dose of arsenic has been small. Charcoal is much used as an external remedy. It is frequently applied to unhealthy wounds and ulcers, especially when accompanied by irritating and offensive discharges; and appears to act beneficially by keeping the parts dry, diminishing the irritating effects of the discharge, and removing its noisome odour. In cases of mange, scab, and grease, it is sometimes sprinkled over the unhealthy surface, or applied along with simple poultices. Charcoal is much used for decolorising and otherwise purifying organic solutions; and the convenience and success of the process usually compensates for the loss of a small quantity of the preparation which the charcoal is apt to retain. Charcoal is a powerful antiseptic and deodoriser, and is in every day use for preventing or arresting the putrefaction of water and many sorts of meat. It is probably also a disinfectant, but is much less effectual than chlorine or sulphurous acid. The dose of charcoal for the horse is between ʒiv. and ℥i.; for cattle, about ℥i.; for sheep, from ʒi. to ʒiij.; and for dogs, from ℈i. to ℈iij. It is most conveniently given suspended in gruel or any other mucilaginous fluid; and for all purposes may be materially increased in effect by raising it to a low red heat shortly before it is to be used.

CHLORINE.

Cl.

Chlorine is prepared by heating sulphuric acid with common salt and black oxide of manganese. For fumigating the Millbank Penitentiary, Dr Faraday used one part of salt intimately mixed with one part of black oxide of manganese, and two parts of oil of vitriol previously diluted with two measures of water. All the ingredients were stirred together in shallow earthen-ware vessels, and where only a slow evolution of gas was desired heat was not used.

Chlorine is a greenish-yellow coloured gas, with a peculiar suffocating odour, an astringent taste, and a density of 2470. It is extensively used as a bleaching agent. When applied to the skin it causes redness and eruption, and produces similar effects on the alimentary canal when swallowed in the state of solution. It is so irritating that it can only be respired in a very diluted state. Its irritant effects are, however, considerably diminished by the force of habit, and are relieved by inhaling ether or the vapour of warm water or alcohol. In veterinary practice chlorine is not used medicinally, but in human medicine it is occasionally inhaled in cases of chronic cough, bronchitis, and phthisis, and is given as an antidote in poisoning by prussic acid and sulphuretted hydrogen. Chlorine is much used as a deodoriser and disinfectant; and appears to owe these properties to its readily uniting with hydrogen, and thus altering the composition of noxious matters exposed to its influence. For deodorising and disinfecting purposes it may be obtained, either as above directed, or by the addition of an acid to chloride of lime or bleaching powder. It should be freely used both in the gaseous and fluid states—large volumes of gas being liberated in the place to be disinfected, and the walls, wood-work, etc., washed with a strong solution. Light must be freely admitted, for without it the action of chlorine is very imperfect; and thorough ventilation is also to be subsequently adopted. When large quantities of the gas are being used, all animals must be removed beyond the influence of its irritant action; but where only small quantities are employed this is unnecessary. Although it appears highly probable that chlorine, when efficiently used, is of considerable service in arresting the progress of such diseases as glanders and farcy, pleuro-pneumonia, and vesicular epizootic, and of maintaining in a pure and healthful state the atmosphere of the habitations of animals, still it must in fairness be mentioned, that cholera and erysipelas in the human subject are stated to propagate themselves readily even when the patients are kept almost constantly surrounded with the fumes of chlorine.—(Pereira's Materia Medica). Such statements, however, are insufficient to shake the strong presumptive evidence in favour of the disinfectant value of chlorine in various contagious diseases affecting the lower animals.

CHLOROFORM.

Ter-chloride of formyle. $C^2 H, Cl^3$, or $Fo\ Cl^3$.

Chloroform was discovered in 1832, nearly about the same time, by Soubeiran and Liebig. Its effects on the lower animals were first observed by Dr Glover, in 1842; while its valuable anæsthetic properties were first discovered and applied by Professor Simpson in November 1847. Since then it has been largely and successfully used for the alleviation of human suffering during surgical operations, parturition, and various diseases, and has also been occasionally applied to similar purposes in veterinary practice.

Preparation.—The cheapest and best way of making chloroform is with the following materials in the subjoined proportions: one pound avoirdupois of chloride of lime (bleaching powder); three pounds of water; and three ounces of rectified spirit. Pyroxilic spirit has been sometimes substituted for alcohol; but the product is of inferior quality. The materials just mentioned are distilled in a roomy retort, with refrigerator and receiver attached; and the chloroform comes rapidly over during the first part of the process. The fluid which collects in the receiver forms two strata—the upper consisting of weak spirit, which may be preserved for the next operation; and the lower of crude chloroform of the density 1220; and, where the above quantities have been used, measuring about nine fluid drachms. In order to char and destroy the deleterious oily matters which this impure chloroform contains, it is agitated with about half its volume of sulphuric acid, which must be carefully freed from nitric acid. Prolonged or repeated contact with the sulphuric acid must, however, be avoided, as it prevents the preparation from keeping well. All trace of acid is then removed by distilling the chloroform, mixing it with quicklime, decanting it off, and again distilling. Dr George Wilson has shown that it may be still further purified by washing it with water, and once more distilling it. Various other modes of purification have been recommended; but this appears to be the simplest and most effectual, and is that followed by Messrs Duncan, Flockhart, and Co., Chemists, Edinburgh, whose chloroform has ever had the highest reputation.

Properties.—Chloroform is a transparent, colourless, oily-looking, mobile fluid, with a density of 1500, a strong sweet taste, and a fragrant etherial and apple-like odour. It volatilizes readily, and boils at 140°. Though not spontaneously inflammable, it can be burned around a wick saturated with alcohol. In burning it forms a dull sooty flame, and evolves hydrochloric acid. Alcohol and ethers dissolve it readily, but water scarcely takes up more than 1-2000th part. It is an active solvent for volatile oils, wax, and resins. The various effects which acids and alkalies have in altering the appearance of a drop of chloroform have been carefully investigated by Dr George Wilson. On dropping chloroform into a saucer, or other shallow vessel containing water, and adding an alkali, he observed that the small, compact, and well-defined drop, so characteristic of pure chloroform, immediately became collapsed and flattened, and sank to the bottom of the vessel; but that, when the alkali was neutralized, by the cautious addition of acid, the flattened globule immediately regained its spherical form, and rose nearly to the surface of the water. This flattening and restoration of the globular form may be repeated again and again, as the water is rendered alkaline or acid. Chloroform consists of one equivalent of the basyle formyle (Fo or C^2H), and three of chlorine (Cl^3); is consequently termed terchloride of formyle; and is represented by the symbol C^2H, Cl^3, or Fo Cl^3.

Impurities.—Chloroform sometimes contains impurities which are apt to render its effects tardy and irregular, and to expose those who inhale it to headaches and nausea; but such impurities are now much less common than they once were, and have never been so serious in Scotch as in English chloroform. The presence of alcohol renders the drops opaline when added to pure water. Sulphuric acid discovers itself by its reddening litmus; whilst chlorine and hydrochloric acid, the most common of its irritating impurities, are easily identified by their action on nitrate of silver, or by their disagreeable acridity, which is indeed occasionally so great as to prevent the chloroform from being respired. Many specimens contain volatile oils, which may be recognised by their blackening sulphuric acid, or evolving an unpleasant pungent odour when a small quantity of the drug contaminated by them is evaporated from the back of the hand. In judging of the purity of chloroform, it is chiefly necessary to note its odour, its behaviour when agitated with sulphuric acid, its reaction on litmus, and its density, which is invariably lowered by the presence of adulterations.

Actions and Uses.—Chloroform is a narcotic poison, an anæsthetic, stimulant, and antispasmodic.

The poisonous narcotic effect of chloroform is very analogous to that of alcohol or ether; and is readily produced by large doses introduced into the stomach, or rapidly inhaled without sufficient admixture of air. It is merely a higher degree of its valuable anæsthetic action. This latter action, as already mentioned, was discovered by Professor Simpson in November 1847, and appears to be produced in the following manner. The chloroform enters the blood and acts directly on the nervous centres, first perverting and then gradually extinguishing their several functions. It seems to affect these centres in a tolerably regular order; involving first those presiding over special sense and volition; next those of common sensation and motion; and lastly, where the influence is unduly prolonged, those which sustain the respiratory and circulatory movements. The symptoms which occur, as the agent successively involves these several parts, have been already fully noticed under the head of Anæsthetics (p. 50). It may be sufficient here to mention that there is at first temporary excitement, with many of the symptoms of inebriation, succeeded by gradually diminishing consciousness of all external objects, weaker and slower respiration, diminution of the animal temperature, muscular relaxation, and insensibility to pain. In animals destroyed by the inhalation of chloroform, the post-mortem appearances are variable. The lungs are usually congested; the heart continues to beat for a considerable time after respiration has ceased, its left side being nearly empty, but its right filled with semi-solid, dark-coloured blood. The veins of the head, neck, and chest are distended with black fluid venous blood; and the membranes of the brain are sometimes congested. Chloroform bears favourable comparison with all other known anæsthetics, being more pleasant to inhale, more powerful and regular in its action, and less apt to cause preliminary excitement, or leave unpleasant effects. It cannot, however, be used so conveniently or safely in the lower animals as in man. In horses, its anæsthetic action is often preceded by considerable excitement; and if, to prevent this, it be given rapidly and in large amount, it occasionally proves fatal. These untoward results are even still more observable among dogs and rabbits. The author has had no experience of its effects on either cattle or sheep. Bees exposed to it speedily become insensible, and while under its influence, may be safely removed from full hives. Plants exposed to its influence also lose their irritability.

The stimulant action of chloroform is exhibited in the preliminary excitement which it produces, either when inhaled or swallowed. This may be readily kept up for a considerable time by giving the medicine in small quantities at short intervals. When chloroform is dropped upon the intestines or bladder, it excites violent peristaltic motion—another evidence of its stimulant action. But when "dropped on the heart, as that organ was contracting, it caused a cessation of the pulsations until it had all evaporated, having a temporary paralysing effect on that organ."[1] It is partly from its stimulant, and partly from its anæsthetic action, that it is so effectual in overcoming spasm.

In veterinary practice, the uses of chloroform are as yet comparatively limited. It is occasionally given to horses to procure insensibility during castration, firing, and other painful operations; but should probably not be used without warning the owner of the possible risk attending its administration, and having at hand an ample supply of the drug in good condition. Among the lower animals, parturition is performed so easily, and with so little apparent pain, that the administration of chloroform, in the great majority of cases, is quite unnecessary. It might, however, be occasionally useful in bitches, when the pups have to be reduced in size before they can be extracted. The inhalation of chloroform has been highly recommended in cases of tetanus; but the spasms are relaxed only so long as the anæsthesia continues, and return with all their wonted severity whenever it ceases; while the benefit derived from the temporary relief is usually more than counterbalanced by the disturbed and excited state into which the animal is apt to be thrown during the administration of the chloroform. In diseases accompanied by violent and long-continued pain, as enteritis, peritonitis, and

[1] Monthly Medical Journal, May 1853, p. 471.

acute rheumatism, a slight degree of anæsthesia might in all animals be of the greatest service in blunting the pain, and so allowing time for the beneficial operation either of medicines, or of the conservative powers of nature. In such cases it may either be inhaled or given in solution by the mouth or rectum. Its inhalation three or four times a day, in quantities sufficient to cause slight anæsthesia, has little, if any, curative effect in cases of pleuro - pneumonia. As an antispasmodic in cases of colic and asthma, it is often, however, of much service, especially when swallowed in a state of dilution, and in doses insufficient to produce any anæsthetic effect.

Doses, etc.—It is somewhat difficult to fix the precise quantity of chloroform necessary to produce anæsthesia. Two or three ounces will generally be effectual in horses, and from one to two drachms in dogs. The exhibition is most simply and safely effected by placing a sponge saturated with chloroform in a nose-bag, perforated with holes to admit a sufficiency of air, and attached to the head. Care should be taken to secure the animal, lest he become unmanageable during the early stages of excitement; as also to supply fresh quantities of chloroform by a tube or other means; and to ensure the entrance into the lungs of an adequate supply of air along with the chloroform vapour. The respiration and the pulse must be carefully watched while the anæsthesia continues, and if an undue effect be produced, the inhalation must be immediately stopped; fresh air allowed to flow in currents about the face; water thrown over the head and neck; and artificial respiration adopted, if necessary. When partial recovery takes place, the inhalation and exhibition of stimulants will also be useful. As a stimulant and antispasmodic, the dose for horses or cattle is f℥i. to f℥ij.; and for dogs, ♏v. to ♏x. These doses are best given in weak spirit, at intervals of an hour or two. A solution of chloroform in spirit, adapted for these stimulant purposes, may now be had ready prepared, under the name of *chloric ether*. Chloroform is sometimes used as a solvent for gutta percha, and the solution is occasionally employed as a substitute for collodion.

CINCHONA.

Bark of different species of Cinchona.

Nat. Ord.—Cinchonaceæ. *Sex. Syst.*—Pentandria Digynia.

Cinchona appears to have been first known in Europe about 1640. For a long time it was used only by the Jesuits (and hence the name it still occasionally bears of Jesuit's bark), but about 1670 its virtues were discovered by an Englishman named Talbot, who sold his secret to the French Government for L.1600, an annuity of L.80, a ten years' monopoly, and the honour of knighthood.

Natural History.—The various plants yielding the different varieties of cinchona bark were long entirely unknown. Many distinguished naturalists have investigated the subject, and within the last few years it has been greatly elucidated by Dr Weddell, who has published his observations in a splendid monograph.[1] He states that nineteen different species yield the various barks of commerce. The *Cinchonaceæ* are trees or tall shrubs, with fine, usually evergreen, foliage, and beautiful fragrant flowers. They abound on the slopes and vallies of the Andes; extend in a comparatively narrow zone from about 10° N. lat. to 19° S. lat.; occur chiefly in groups or solitary trees; and thrive best with a good deal of moisture, a mean temperature of about 60°, and an elevation between 4,000 and 10,000 feet above the level of the sea. The bark is collected from May to November, being removed from the trees sometimes while they stand, but more commonly after they have been felled. It is then carefully dried, the thick pieces from the trunk remaining flat, and the thinner portions from the branches curling into quill-like forms. It is packed in chests or in cerones, which are formed of hides

[1] Histoire Naturelle des Quinquinas. Fol. Paris, 1849.

or coarse cloth, and contain from 70 to 150 pounds of the bark, and is exported from Bolivia and other places along the coast of Peru, whence its vernacular name of Peruvian bark.

Varieties.—There are from forty to fifty different sorts of bark met with in commerce, but those in common use have, for convenience of description, been divided into pale, yellow, and red barks.

The PALE CINCHONAS are usually in thin fibrous rolls or quills, and are stripped from branches or young trees, which, as they grow older, often yield the darker barks. Their powder is light coloured, astringent rather than bitter, and contains cinchonine, but little or no quinine. *Crown bark*—a well-known and esteemed variety of the pale cinchonas—is the produce of the *C. condaminea*, occurs in quills from six to fifteen inches long, and about the size of the finger, and is invested with a grey or tawny epidermis, which is always entire, marked with longitudinal furrows, and transverse cracks, and covered with lichens. The inner surface of the bark is red or cinnamon brown; and the powder, which is lighter than that of either the red or yellow barks, has the same colour. The *grey* or *silver bark* is another of the pale cinchonas. It is of fine quality, but less used than crown bark.

The YELLOW CINCHONAS (*Cinchonæ flavæ*) include a great variety of barks, but by far the most important is that receiving the specific title of *yellow cinchona* or *C. regia*. It is very highly prized on account of its containing a large quantity of quinine. It occurs both in quills and flat pieces, the latter being the most esteemed. Its epidermis is brown, rough, fissured, and often covered by white or yellow lichens; its inner surface is smooth and yellow; its structure fibrous; and its powder yellow orange. It has an aromatic odour, and a bitter taste, without much astringency. When infused in water, it yields a precipitate of sulphate of lime, with a strong solution of sulphate of soda. Dr Weddell has shown that it is obtained from the *C. Calisaya*—a tall tree found in the warm climates of Bolivia and South Peru, and distinguished by its stout naked stem and leafy summit overtopping the rest of the forest.

The Red Cinchonas (*Cinchonæ rubræ*) include several commercial varieties, are the produce of different species, and owe their distinctive colour chiefly to the manner in which they are procured and dried. They usually occur in flat pieces, which vary in length and thickness, and have a red, rough, wrinkled epidermis, a fibrous red-brown interior, a feeble agreeable odour, and a strong astringent taste. They are of excellent quality, and yield a good proportion both of quinine and cinchonine.

Besides these superior varieties of pale yellow and red barks, there are various others of inferior quality, which are much used to adulterate the more valuable sorts. Such are the ash, rusty, and the various kinds of Carthagena bark.

Properties.—All the cinchonas have certain common characters. They occur either in quills or flat pieces, and have a slightly aromatic odour, and an astringent and somewhat bitter taste. Their colour varies considerably, but is always deepened by exposure to moisture. They are soluble in cold and hot water, and in alcohol of all densities; but their best solvents are proof spirit and diluted acids. When solutions of cinchona are exposed to a high or prolonged heat, the colouring matter of the bark unites with the alkaloids, forming insoluble compounds; and on this account decoctions and extracts are ineligible preparations. When infused in four parts of boiling water for twenty-four hours, and then filtered, the superior qualities of bark are precipitated by solution of nut-galls, potash, and ammonia. The precipitates thus produced are chiefly the alkaloids of the bark. Owing to the presence of tannin, solutions of gelatine and tartar emetic, when added to infusions of cinchona, produce white or grey precipitates, and persalts of iron, dark green precipitates.

Composition.—Cinchona contains the following constituents:—

Quinine or *Quina*, an alkaloid found most abundantly in the yellow bark, and used as a tonic and antiperiodic, chiefly in the form of a sulphate. When a solution of that salt is treated with ammonia, the alkaloid is precipitated as an amorphous, white, odourless powder. It may also be got in delicate, needle-like crystals, by slowly evaporating a concentrated solution. It has an intensely bitter taste; and dissolves sparingly in water, but readily in diluted acids, with which it forms crystallizable, moderately soluble salts, having all the virtues of the pure alkaloid. Quinine, according to Liebig, consists of C^{20} H^{12} N O^2.

Quinidine, an alkaloid recently discovered in most of the barks of Peru and Bolivia, bearing close resemblance to quinine, and found associated with amorphous quinine (p. 185).

Cinchonine is chiefly present in the pale barks, and may be obtained by subjecting them to the process for sulphate of quinine (p. 184). The alkaloid occurs in colourless, quadrilaterial, insoluble crystals, having a feebly bitter taste, and consisting of C^{20} H^{12} N O. Like quinine, it is a powerful tonic, but is scarcely ever used medicinally.

Aricine, a fourth alkaloid analogous to cinchonine, discoverable in only some varieties of bark, and of less importance than the alkaloids already mentioned.

Cinchonic or *Kinic Acid*, existing in combination with the alkaloids, and with lime, acid to the taste, crystallizable with difficulty, undergoing decomposition when heated, and comporting itself in most respects like acetic acid.

Tannin, resembling that of catechu, and easily recognised by its precipitating gelatine, tartar emetic, and persalts of iron.

Cinchonic Yellow and *Cinchonic Red*, two colouring matters, uncrystallizable, partially soluble in water, readily dissolved by alcohol and diluted acids, and when heated readily forming, with the alkaloids, insoluble and nearly inert compounds. Besides these more characteristic constituents, cinchona further contains a concrete oil, a trace of volatile oil, starch, gum, resin, lignine, and salts of lime.

Impurities.—Inferior and spurious cinchonas are apt to be substituted for the better varieties. This may be discovered by noting carefully the general appearance, fracture, colour, odour, and taste of any suspected specimen; and likewise especially the proportion of alkaloids which it contains. 1000 parts of good yellow bark yield from 11·7 to 23·4 parts of quinine.

Actions and Uses.—Cinchona bark is, in large doses, slightly irritant; and, in medicinal doses, astringent, antiseptic, tonic, and antiperiodic.

Large quantities in the state of powder cause irritation of the alimentary mucous membrane, increased force and frequency of the pulse, and in the dog vomiting. In rabbits thirty grains caused debility, and sixty grains death. (Christison). An ounce and a half of a strong decoction injected into the jugular vein of a dog caused, after the lapse of about fifteen minutes, vomiting, violent palpitations, and spasms; and, on half an ounce more being injected, tetanus and death. Its astringent properties depend upon the presence of tannin, and are exerted both on dead and living tissues. A strong solution increases the cohesion of portions of the intestines, blood-vessels, or other parts steeped in it; and in living animals counteracts relaxation, arrests excessive secretion, and when given for some time causes perceptible thickening and contraction of the intestines. It also improves the appetite, promotes healthy digestion, strengthens the pulse without quickening it, and augments the general power and vigour. Hence it is a valuable tonic. It unites the various properties of a tonic, bitter, and astringent; but, in properly regulated doses, is devoid of any very obvious stimulant action, or any irritant effect on the alimentary canal. It possesses a remarkable power of arresting periodic diseases (diseases in which the symptoms occur at stated intervals), as ague in man, and some sorts of fevers and nervous diseases. This antiperiodic action of cinchona bark is owing to the alkaloids present in it, and is possessed by no other medicines except arsenic and salts of bebeerine. It appears, however, to occur quite independently of any tonic effect, being sometimes developed in a few hours, and by one or two doses. The manner of its production is unknown, but results, as some think, from a peculiar stimulant action on the nervous system.

Cinchona is of much service in all diseases characterised by impaired appetite, weak pulse, and general atony; as in chronic diarrhœa, and other inordinate mucous discharges depending on defective tone; in passive hemorrhages; convalescence from debilitating complaints; consumption, and other forms of scrofula; diabetes; glanders; and sheep-rot. In these two last diseases it is, like other tonics, a valuable palliative, but not, as some have considered, a perfect or certain cure. As an antiperiodic it is used advantageously in intermittent fevers in all animals, in chorea in dogs, and in periodic ophthalmia or moon blindness in horses, in the treatment of which it is highly extolled by French veterinarians. It has sometimes been given with benefit in rheumatic affections both of horses and cattle. It is contra-indicated in all cases of acute inflammation or fever, except of an intermittent or typhoid type; and should also be avoided when there is much irritability of the alimentary canal.

It is occasionally used externally as an astringent and antiseptic; but for these purposes it may be advantageously replaced by more efficient and cheaper remedies.

Doses, etc.—The doses for horses or cattle are from ℥i. to ℥iij.; and for dogs, ʒi. to ʒiij.; repeated twice or thrice a day for several days continuously. If nausea or vomiting supervene, the dose should be considerably reduced. It is usually administered in the form of a bolus, and is often conjoined with camphor, gentian, or ginger. Infusions and tinctures are occasionally used. The former may be made by infusing for some hours in a covered vessel one part of powder, and ten or twelve parts of boiling water, and then straining. The latter may be conveniently prepared by the following process of the Ed. Phar.:—

"Take of yellow bark in fine powder (or of any other species of cinchona, according to prescription) eight ounces; proof spirit, two pints; percolate the bark with the spirit, the bark being previously moistened with a very little spirit, left thus for ten or twelve hours, and then firmly packed in the cylinder. This tincture may also be prepared, though much less expeditiously, and with much greater loss, by the usual process of digestion, the bark being in that case reduced to coarse powder only."

SULPHATE OR DISULPHATE OF QUININE (*Quinæ Sulphas*) possesses in a concentrated form all the properties of cinchona bark. As it is always procured from the manufacturing chemist, it is unnecessary to enter into minute details regarding its preparation. Excellent directions for making it will be found in the Edin. Phar. The yellow bark, being more productive than any of the other varieties, is chiefly used for its preparation. The colouring matters and acids of the bark are first removed by decoction with water and carbonate of soda, and the residuum boiled with water acidulated with sulphuric acid. The solution is concentrated, and some carbonate of soda added to separate the alkaloid, which is then converted into a sulphate by the addition of a small quantity of very diluted sulphuric acid. The salt is purified and rendered colourless by one or two crystallizations. The proportion of sulphate of quinine yielded by the different sorts of bark varies from one to four per cent.

Properties.—Sulphate of quinine occurs in fine, silky, colourless, odourless crystals, which adhere together in little tufts, and have an intense, pure, bitter taste. When exposed to the air it effloresces, giving off three-fourths of its water of crystallization. It is soluble in 740 parts of cold water, and about 30 of boiling water; and its solubility is greatly increased by the addition of a few drops of sulphuric acid. Its acidulated watery solution has a faint blue tint. With alkalies and alkaline carbonates it yields white precipitates of quina; and, with infusion of galls, a white precipitate of tannate of quina. When treated first with chlorine, and then with ammonia, a green-coloured solution is produced, from which a green precipitate shortly separates. A still better test has been recently proposed by M. Vogel, junior: A drop of chlorine water, and then a concentrated solution of ferrocyanide of potassium, produces a bright red colour, passing, after some time, into green. Sulphate of quinine contains two equivalents of quinine, one of sulphuric acid, and eight of water.

Impurities.—Sulphate of quinine is liable to various adulterations. The most common are sulphate of lime, detectable by incineration; and sugar, discoverable by the sweetness of the residuum left on evaporating a solution. When sugar, starch, or other organic matters are present, the salt forms, with cold concentrated sulphuric acid, a coloured, instead of a colourless, solution. The simplest tests for its purity are its being entirely dissipated by heat, and entirely dissolved in acidulated water.

If the mother liquor from which quinine has been crystallized be treated with an alkali, a precipate is formed which, when washed and fused, is a dark-brown brittle uncrystallizable substance, having the same composition as quinine, and now well known as *amorphous quinine* or *chinoidine.* It is identical in its action with quinine, and is considerably cheaper.

Actions and Uses.—The actions and uses of sulphate of quinine are very similar to those of cinchona. It is, however, devoid of astringency, and is less apt to cause nausea. Like many other medicines of vegetable origin, its effects are more observable in omnivora or carnivora than in herbivora or graminivora; and, like other tonics, its actions are more apparent during weakness and disease than during health. It is beyond all comparison the most powerful and certain of vegetable tonics, and is an active antiperiodic. It is of much value in loss of appetite, and weak digestion depending on debility; in convalescence from acute complaints; and in chronic exhausting diseases. There is no tonic better adapted for dogs, especially when suffering from distemper. From the rarity of periodic diseases among the lower animals, veterinarians have little opportunity of observing the antiperiodic virtues of sulphate of quinine. They are, however, believed to be sometimes exerted in chorea in dogs, and in constitutional or deep-seated ophthalmia in horses. Sulphate of quinine, when given with cathartics, is believed to increase their activity; but its actions in combination have as yet been imperfectly studied.

Doses, etc.—The dose for horses and cattle is from grs. xx. to ℈ij.; for sheep, about grs. x.; and for dogs and cats, from grs. ij. to grs. x. These doses should be repeated thrice a day; and when the medicine is given as a tonic, it should be persevered in for some days, and occasionally alternated with other remedies of the same class.

It may be given in the form of a ball, either alone or made up with ginger, gentian, camphor, or valerian. It is conveniently administered to the dog in a spoonful of gruel or a bit of meat. The solution in water, acidulated with a few drops of sulphuric acid, is often used, and is the form preferred in human medicine. Sulphate of quinine is one of those remedies which have been applied by the endermic method. A small blister is applied, the vesicles formed are laid open, and the medicine in powder scattered over the exposed surface of the true skin, from whence it is readily absorbed, and produces its effects in the same manner as if given in the usual way. The desired effect, however, is said to be produced by a lesser quantity of the remedy.

Other salts of quinine besides the sulphate have at various times been proposed for use; but as the quinine is the important element alike in all the salts, and retains its properties unchanged in all its ordinary forms of combination, it is obviously of little importance which salt is employed. The sulphate, however, is probably one of the most convenient, on account of its being easily and cheaply prepared. The alkaloid itself has sometimes been used, but has nothing specially to recommend it. The amorphous quinine should not, however, be forgotten, as it appears to be as effectual as any of the other preparations, and considerably cheaper.

COD-LIVER OIL.

Morrhuæ Oleum. Oleum Jecoris Aselli.

Cod-liver oil is usually prepared by boiling the livers of cod, and occasionally of other fish, with water, allowing them to digest for some time, and then skimming off the oil, and purifying it by filtration and expression through a cloth. It has a pale yellow colour, and an oily, fishy taste, which, however, becomes less obvious to those long accustomed to take it. It consists of oleic and margaric acids, united with glycerine or an analogous principle; and contains, besides, small quantities of resinous biliary matters, phosphorous, iodine, bromine, and salts. The undoubted curative influence of the oil, especially in the human subject, probably depends on the conjoined effect of these naturally mixed ingredients, and particularly on the fatty matters, which are perhaps present in an unusually assimilable state. From careless preparation, it is often very dark coloured and exceedingly nauseous.

Actions and Uses.—Like other fixed oils, it causes, when given in large doses, derangement of the bowels and purgation; but in small and repeated doses becomes assimilated, and increases the intercellular fat. Dr Pollock has published in the "Lancet" (5th November 1853), some interesting experiments made by an Essex agriculturist, regarding the fattening action of cod-liver oil on pigs, sheep, and cattle. Twenty pigs, separated from a lot of three hundred, averaging in weight from five to fifteen stones, received two ounces of oil daily, with as much meal as they pleased. The rest of the lot were treated in exactly the same manner, but got no oil. Those receiving the oil consumed less food, and when killed "weighed the heaviest, and made the most money in the London market, the fat being firm and white." When the quantity of the oil was increased to four ounces per day, the fat became yellow, and the flesh acquired a fishy taste. For small pigs, an ounce daily was found the most economical quantity. An ounce of oil given daily to sheep, induced a decided improvement in the quality both of the fat and flesh; while cattle, receiving on an average about half a pint daily, ate less food, and paid better, than when treated in the usual way. The oil, it is mentioned, cost from 2s. 8d. to 3s. per gallon; and in some comparative experiments, is said to have proved itself superior to sperm oil.

These experiments go to confirm the fact, now generally admitted by all scientific agriculturists, that a certain quantity of oleaginous material is of much service in the speedy and economical fattening of animals, in the saving of food, and in the improvement of the quality both of the fat and flesh. They do not, however, establish the individual superiority of cod-liver oil over other oleaginous matters. Equally satisfactory results would no doubt have been obtained from the use of rape, linseed, or any other fixed oil. To ascertain the relative fattening value of these several bodies, would require repeated and careful comparative trials. In the meantime, however, the choice, for feeding purposes, of one oil rather than another, must be chiefly determined by its price.

For certain medicinal purposes, however, cod-liver oil appears preferable to any other oleaginous matter; and is now extensively prescribed for the cure of scrofula in the human subject. For cattle and horses, it is usually superseded by linseed and similar oleaginous matters. Dr Pollock's Essex correspondent mentions, however, that it materially relieves broken-winded horses. It may be advantageously given to dogs in all forms of scrofula, protracted cases of distemper, inveterate skin diseases, and chronic rheumatism, especially that variety known as kennel-lameness, and depending upon damp, bad feeding, and mismanagement.

Doses, etc.—It may be given to dogs in doses of half an ounce twice a day, and persevered with for a considerable time. To lessen its naseous flavour, it may be exhibited in milk or gruel, with a small quantity of any ordinary aromatic.

COLCHICUM.

Meadow Saffron. Cormus or bulb and seeds of *Colchicum autumnale.*

Nat. Ord.—Colchicaceæ. *Sex. Syst.*—Hexandria Trigynia.

The *Colchicum autumnale* or autumn crocus grows wild in the lawns and pastures throughout many of the mild moist parts of the island, and is also cultivated in many gardens. It has an annual stem; a lilac or purple flower; numerous roundish, brown, bitter-tasted seeds, about the size of those of the millet; and a biennial root, which, about the month of June, and when about a year old, produces near its lower end a small bulbule. This offshoot gradually increases in size, sends up in autumn a flowering stem, and in spring the familiar crocus leaves with the seed vessel. By the month of July it attains its full growth, being about the size of an apricot, and beginning in its turn to form a young bulb. Meanwhile, the parent bulb has been gradually wasting, until, during the second summer of its own existence, it becomes a dry, shrivelled, shapeless mass attached to the lower surface of its full grown progeny. Previous to this, however, generally during the spring months, it sometimes produces one or two small immature bulbs, which, after separation from the parent bulb, probably require several years to come to perfection. The corm or bulb, which is the chief officinal part of the plant, is usually taken up in June or July, when plump, rich in starch, and about a year old; but Professor Christison considers that, though more shrivelled and watery, it probably continues equally active throughout the succeeding winter and spring.[1] The bulbs, when dug up, are stripped of their brown integument and cut into slices, which are dried at a temperature not exceeding 150°, and should be of a greyish-white colour, dry, and firm, with a bitter, acrid taste. They yield their active principles to spirits and vinegar, the latter of which forms their cheapest and most convenient solvent. The bulbs contain water, starchy matter, lignine, gum, and a bitter, crystallizable, poisonous alkaloid called *colchicine*, similar to veratria, and present in other parts of the plant as well as in the bulb.

Actions and Uses.—Colchicum is, in large doses, an irritant poison; and in medicinal doses cathartic, diuretic, emetic, and sedative.

Its poisonous irritant effects are little seen in graminivora or herbivora; but are readily produced in carnivora. Two drachms of the dried bulb caused in dogs vomiting, diarrhœa, diuresis, depression of the heart's action, and death in five hours. A tenth of a grain of colchicine given to a cat occasioned salivation, vomiting, purging, staggering, extreme langour, colic, and death in twelve hours. (Christison on Poisons, p. 881). The emetic and cathartic effects of colchicum are violent and irregular; and its diuretic action is less certain than that of many more common remedies. It is only used on account of its sedative influence, which is best developed by the administration of small and frequently repeated doses. It has been highly recommended by Mr Hallen, V.S., 6th Dragoon Guards, and by Mr Phillips, V.S., 7th Hussars, in the treatment of rheumatism and rheumatic influenza; and appears most effectual in those subacute cases in which the inflammation flies from joint to joint. Other practitioners also speak favourably of it in deep-seated or constitutional opthalmia. In the human subject it has the effect of producing, even after a very few doses, a marked increase in the urea and uric acid excreted by the kidneys.

Doses, etc.—The dose of the powdered corm or seeds is, for horses or cattle, ʒss. to ʒij.; and for dogs, grs. ij. to grs. viij.

[1] Professor Christison has investigated this subject with much care, and published the results of his observations in his Dispensatory, from which the above remarks have been abridged.

The powder is commonly used, and a convenient solution may be made with one part of colchicum, six or eight of vinegar, and a little spirit.

COPPER AND ITS MEDICINAL COMPOUNDS.

COPPER. Cuprum. Cu.

Copper is a brilliant red metal, deriving its name from the island of Cyprus; crystallizing in regular octohedrons or cubes; and having a specific gravity of 8·8, a nauseous bitter astringent taste, and an unpleasant odour, especially when rubbed. It is malleable, ductile, and readily oxidized. Its principal ore is the sulphuret; and its chief officinal salts—the sulphate, iodide, and acetate. Its various salts, when hydrated, have a green or blue colour, and are distinguished in solution by the following tests: sulphuretted hydrogen, or hydrosulphuret of ammonia, gives a black precipitate of sulphuret of copper ($Cu\ S$); potash or soda, a greenish-blue precipitate of oxide ($Cu\ O$); ammonia, a similar precipitate, which redissolves on further addition of the precipitant, forming a deep blue liquid ($2NH^3$, CuO, NO^5); and ferrocyanide of potassium, a chocolate brown precipitate of ferrocyanide of copper (Cu^2, $FeCy^3$). Another good test is to place in the solution a piece of polished iron or steel, which quickly becomes coated with a red crust of metallic copper. All the salts of copper closely resemble each other in their actions, being irritant and caustic in large doses, and astringent and tonic in medicinal doses. Copper, however, so long as it remains metallic, is devoid both of poisonous and medicinal effect. Drouard "gave as much as an ounce of finely divided copper to dogs of different ages and sizes; but none of them experienced any inconvenience therefrom."—(Pereira.) As with other metals, however, copper acquires activity when converted either into an oxide or salt. Animals depastured in the neighbourhood of copper smelting works are occasionally affected by loss of appetite, impaired digestion, falling off in condition, hectic fever, and various diseases of the bones—effects which, though usually ascribed to the ingestion of small quantities of copper, more probably depend upon the arsenious acid which these smelting furnaces evolve in considerable amount. It must not, however, be thence inferred that copper may be taken for an indefinite length of time with impunity. There is no doubt that injurious effects, such as have frequently taken place in the human subject, might occur in the lower animals, and especially in the dog, from the use of food or drink which has acquired a cuprous impregnation from being boiled in copper vessels and allowed to remain in them while cooling. Acidulous and fatty matters are most apt to become thus contaminated, and especially if kept long in contact with copper, which is at the same time freely exposed to air and moisture.

SULPHATE OF COPPER. Blue Vitriol. Blue Stone. Vitriol of Copper. Cupri Sulphas. $CuO, SO^3, +5HO$.

Sulphate of copper may be prepared by dissolving the black oxide in sulphuric acid; but more cheaply and conveniently by roasting the sulphuret of copper, or copper pyrites (Cu S), when both its copper and sulphur absorb oxygen, forming oxide of copper and sulphuric acid, which unite. The salt so procured is dissolved in water, and then crystallized. It usually contains a trace of iron, which does not, however, interfere with its medicinal uses. It occurs in azure-blue rhomboidal prisms, and has a specific gravity of 2·2, and a strong styptic metallic taste. When exposed to the air it effloresces and becomes covered with a greenish-white powder of the carbonate. It is soluble in about two parts of boiling water, and four of cold.

Actions and Uses.—In large doses, sulphate of copper causes irritation of the alimentary canal, various nervous disorders, and death. In medicinal doses, it is tonic and astringent; and in virtue of its irritant action, is an emetic for the dog. Hertwig mentions that large doses (as above twelve drs. for horses and cattle, one dr. for sheep or swine, and half a drachm for dogs) cause indigestion, impaired appetite, in carnivora vomiting; also diarrhœa, inflammation of the stomach and intestines, and usually death. Drouard[1] found that six grains of the sulphate, introduced into the stomach of a dog, killed it in half an hour; but left no appearance of inflammation. Mitscherlich further found that two drachms caused speedy death, but left no apparent inflammation, and no abnormal condition except " blueness of the villous coat of the stomach, mingled with brownness, the apparent effect of chemical action."[2] The same observer also mentions that a drachm applied to a wound caused in dogs rapid prostration, and death in four hours. Injected into the jugular vein, it speedily reduces and arrests the action of the heart, fifteen grains proving fatal in twelve seconds. In poisoning by salts of copper, the appropriate remedies are plenty of mild diluents, with white of egg, milk, and other albuminous substances, which cause the formation of an insoluble innocuous albuminate of copper. The sulphate and other salts of copper, whether administered in poisonous or medicinal doses, become absorbed, and have been detected by Professor Orfila and others in the blood and most of the internal organs.

Sulphate of copper is much used as an astringent and tonic in cases of atony and general feebleness. Though indubitably valuable for horses and dogs, it is still more so for cattle, in which the milder tonics are sometimes of comparatively little use. In scrofula, dysentery, glanders, and farcy, it arrests abnormal secretion from the bowels, improves the appetite, increases the general vigour, and often wards off the fatal result for a considerable period. In such cases it is often conjoined with opium. Like other active tonics, it is very useful during recovery from exhausting disease. It is applied externally as an astringent in cases of chronic ophthalmia, morbid conditions of the Schneiderian, and other mucous membranes, scurfy affections of the skin, fistulous wounds, farcy buds, exuberant granulations, and superficial hemorrhage from minute vessels. From its uniting with sulphuretted hydrogen and hydrosulphuret of ammonia, it is occa-

[1] Inaugural Dissertation. Paris, 1802. Quoted by Christison on Poisons, p. 461.
[2] Christison on Poisons, p. 462.

sionally used as a deodoriser; but for this purpose it is not so convenient or effectual as chloride of lime or sulphurous acid.

Doses, etc.—As a tonic and astringent the dose for horses is from ʒi. to ʒij.; for cattle, ʒij. to ʒiv.; and for dogs, gr. i. to grs. iij. These doses should be repeated at least thrice a day, and administered either in a bolus or dissolved in some mucilaginous solution. As an emetic for the dog, the dose is from grs. x. to grs. xv. dissolved in water. For external purposes the salt is usually applied either in powder or solution.

Ammonio-Sulphate of Copper. Cuprum Ammoniatum. $NH^3\ CuO + NH^3\ SO^3, HO$. (Pereira).

The ammonio-sulphate of copper is generally prepared by triturating sulphate of copper and sesqui-carbonate of ammonia until effervescence ceases, wrapping the mass in bibulous paper, drying it, and preserving it in closely stoppered bottles. It may be prepared in a hydrated state by adding ammonia to a solution of sulphate of copper until the precipitate first thrown down is nearly re-dissolved; and in this condition it is used as a test for arsenic. The dried salt has an azure blue colour, a metallic coppery taste, and a powerful ammoniacal odour. Unless carefully protected from the air it speedily loses ammonia. There is still much difference of opinion regarding its composition. The formula above mentioned is that given by Pereira.

Actions and Uses.—Its actions and uses are closely analogous to those of the sulphate. Doses of several drachms destroy dogs with intestinal irritation, and symptoms of nervous derangement. Two to four drachms are administered with benefit to horses and cattle in influenza, pleuro-pneumonia, consumption, and all other complaints accompanied by atony and debility; and to dogs as a stimulating tonic in chorea and other nervous affections. In veterinary practice, however, it has not been used sufficiently long or extensively to enable us to form an accurate estimate of its value as compared with the common sulphate. It is administered in the same or somewhat lesser doses than the sulphate, and is also applied externally for similar purposes.

IODIDE OF COPPER. Cupri Iodidum. Cu, I.

Iodide of copper, though not mentioned in any of the Pharmacopœias, has been noticed by Mr Morton, and is occasionally used in veterinary practice. It is usually prepared by decomposing sulphate of copper by iodide of potassium (both in solution), and collecting and drying the precipitate. It might, however, I think, be more easily and economically prepared by the direct combination of iodine with copper filings or clippings, as in the preparation of the iodide of iron.

It is a fawn-coloured salt, has a disagreeably styptic, coppery taste, and evolves an odour of iodine, especially when rubbed. The chief excuse for its introduction into practice was the belief that it possessed the conjoined actions of its two constituents. But this is by no means established. Indeed, its effects in large doses, in which its characteristic actions should be most obvious, resemble those of other salts of copper, and bear no analogy to those of iodine. It has been chiefly recommended as a stimulating tonic, in glanders, farcy, "and chronic œdematous enlargements of the legs," and as an astringent in ill-conditioned ulcerations and inveterate grease. (Morton's Pharmacy). As yet, however, there is no sufficient evidence of its superiority to the sulphate, which is preferable to all the other salts of copper, on account of its being cheap and easily obtained.

SUBACETATE OF COPPER. Verdigris. Blue Verdigris. Ærugo. $2\,CuO, \bar{A} + 6\,HO$. (Phillips).

Chemists have described at least five several compounds of oxide of copper and acetic acid; but only one of these is of much medicinal importance, namely, the sub- or di-acetate. There are two varieties of this salt—one made in this country, and distinguished by its green colour; the other made abroad, especially in the south of France, and of an azure blue colour. It is usually prepared by placing plates of copper in layers alternated either with cloths saturated with acetic acid, or, according to the foreign process, with the moistened husks of the grape and the refuse of the wine process. The copper, being thus exposed for about a month to the conjoined action of air and acid, becomes oxidised, and subsequently unites with the acetic acid. The salt thus formed is scraped off, dissolved, and crystallized.

Properties.—It occurs either in amorphous masses or powder, is either blue or green, according to the mode of its preparation, and has the taste and odour of a salt of copper. It remains unchanged in air, but when heated, gives off water and acetic acid, leaving a residue of oxide and metal. When treated with hydrochloric acid, it should not leave more than 5 per cent. of residue or impurity undissolved.

Actions and Uses.—Verdigris, like the other salts of copper, is a peculiar irritant poison, an emetic, tonic, and astringent. Drouard exhibited twelve grains to a strong dog while fasting; and observed that it "caused aversion to food, efforts to vomit, diarrhœa, listlessness, and death in twenty-two hours." In some cases, paralysis of the hinder extremities was also observable, but in none was the stomach much inflamed. The neutral acetate ($Cu\,O, \bar{A}, HO$) appears more active; for Orfila found that from twelve to fifteen grains given to dogs, produced, besides the symptoms above mentioned, convulsions, tetanus, sometimes insensibility, and death within an hour. (Christison on Poisons, p. 461). Hertwig observed that one ounce, administered to a horse, caused colic, with acceleration of the pulse; and that two ounces, given some hours after, aggravated these symptoms, causing first acceleration and then depression of the pulse, debility, and, after six days, convulsions and death. The irritant properties of verdigris render it a prompt and effectual emetic for dogs and other carnivora; but its use is not to be commended, as it is very liable to become absorbed, and act as a poison. It is employed both internally and externally for the same purposes as the sulphate, and in the same doses. For external application it is used in the several forms of powder, solution, and ointment, the last of which may be conveniently made with one part of verdigris and eight or ten of lard or of resinous ointment.

CORIANDER.

Coriandrum. Fruit of *Coriandrum sativum*.—(Ed. Phar.)

Nat. Ord.—Umbelliferæ. *Sex. Syst.*—Pentandria Digynia.

Coriander is a brown, globular fruit about the size of white pepper, and is made up of two plano-convex halves, cohering by their flattened surfaces. The agreeable aromatic odour and taste, as well as the medicinal properties of the fruit, depend on the presence of about 4·7 per cent. of volatile oil. The actions and uses of coriander are identical with those of anise, fennel, and other plants of the order. It is more important as a flavouring ingredient than a medicine.

CREASOTE.

Creasotum. $C^{14}\ H^{8}\ O^{3}$.—(Deville.)

Creasote is one of the most interesting products of the distillation of wood; is present in wood-smoke, in pyroligneous acid, and in tar, whether of wood, coal, or peat; and confers on these substances their well-known antiseptic properties. It is usually obtained from wood-tar by a tedious and complex process, followed only on the large scale. A somewhat simpler process has been recently proposed; namely, distilling tar into a barrel half filled with water, removing the watery fluid which floats on the surface, adding sulphuric acid to the heavier residue, boiling the mixture, exposing it to the air for three days, with frequent stirring, and distilling it repeatedly. Tar of good quality is said to contain from 20 to 25 per cent. of creasote. (Gregory).

Properties.—Creasote is a mobile, oily-like fluid, which is colourless and transparent when first prepared, but unless very pure soon becomes brown. It has a strong, persistent, smoky odour, and a pungent, acrid taste, with a sweet after-taste. It has a density of about 1066; burns readily, with a sooty flame; boils at 397°, and freezes at 16°. It readily dissolves in small quantities of acetic acid, alcohol, and volatile oils, and in from

80 to 100 parts of water. From its coagulating albumen, it corrodes the skin and other animal tissues, and unites with them, forming insoluble compounds, which resist putrefaction.

Impurities.—Creasote is apt to contain certain impurities, as colouring matters, with fixed and volatile oils—some of them produced, like itself, during the distillation of wood. When pure, it possesses the following characters:—" Colourless, and remains so under sunshine; density 1066; entirely and easily soluble in its own volume of acetic acid; a drop on white filtering paper, heated for ten minutes about 212°, leaves no translucent stain."—(Ed. Phar.)

Actions and Uses.—Creasote is a narcotico-irritant poison, a sedative, anodyne, astringent, and antiseptic.

Doses of three drachms given to horses caused merely slight and temporary feverishness, and imparted to the breath a creasote odour (Hertwig). Dr Cormack,[1] whose treatise on creasote still remains the best authority on the subject, observed that, when given to dogs in doses of about thirty drops, it caused uneasiness, copious salivation, vertigo, twitching of the external muscles, convulsions, enfeebled and fluttering action of the heart, laboured breathing, diminished sensibility, dulness, and stupor. The symptoms came on within a few minutes, and continued for two or three hours. For a day or two, however, irritability of the stomach, occasional vomiting, and dulness, were still observable. Two dogs got each two drachms, and died within three hours, evincing, besides the symptoms above mentioned, violent convulsions, and complete coma. A rabbit was thrown into convulsions, and died within a minute, from the effects of thirty drops. In all cases, the heart and lungs were much engorged with blood, and the heart, even when examined immediately after death, very insensible to the action of stimuli. This paralysis of the heart is especially observable when poisonous doses are injected into the veins. The stomach and intestines are slightly inflamed, particularly when the animals have survived

[1] Treatise on Creasote. By John Rose Cormack, M.D. Harveian Prize Dissertation for 1836.

for some hours. Creasote, whether in poisonous or medicinal doses, becomes rapidly absorbed, and appears to act especially on that part of the nervous system presiding over the action of the heart. It seems to pass from the body by almost all the excreting channels. In order to arrest the poisonous action of creasote, the stomach should be evacuated; ammonia and other diffusible stimuli administered to rouse the sinking action of the heart; and blood drawn from the jugular vein in order to relieve the congestion of the lungs and of the right side of the heart.

On account of its physiological action on the heart, creasote has been occasionally administered as a sedative in cases of irritation and inflammation. About two years ago, it was used at the Edinburgh Veterinary College in a good many cases of pleuro-pneumonia among cattle, in doses varying from twenty to eighty drops, dissolved in oil or acetic acid; but although of considerable temporary advantage in allaying irritability, it was, when judged by the proportion of cases cured, little, if at all, superior to other medicines. Like almost every other article of the materia medica, it has been tried in glanders and farcy, but without any very striking results. It was at one time recommended in that form of diabetes common in horses; but appears to aggravate rather than ameliorate the disease. In men and dogs it is a valuable remedy for allaying irritability and chronic vomiting—in this, as in other respects, bearing considerable resemblance to prussic acid. It is much used externally in the treatment of ulcers, caries, scrofulous tumours, fistulæ, canker, thrush, and foot-rot; as also in grease, mange, and such other cutaneous diseases. In these and such like cases it acts beneficially as a stimulant and astringent, an antiputrescent and a deodorizer. Like other astringents, it has been used in diluted solution for the cure of superficial and circumscribed inflammation, such as that of the conjunctiva. In the human subject it is a valuable anodyne in cases of toothache depending on caries; and rarely fails to afford speedy and lasting relief, probably by uniting with the albuminous matter in the hollow of the tooth, and thus protecting the nervous pulp from the action of air and other irritants. The antiseptic properties of creasote are exceedingly energetic. It is believed to have been the essential agent used in embalming the Egyptian mummies. It is extensively employed in preparing various dried meats; and might be used for preparing subjects for dissection, by dissolving it in acetic acid, and injecting the solution into the veins.

Doses, etc.—The usual dose for horses or cattle is from ♏xx. to ♏xl.; and for dogs, from ♏i. to ♏iij. It is best given in a mass with syrup, or in a solution made with acetic acid, oils, or alcohol. For external purposes it is used alone; as a solution in acetic acid, oils, or water; and as an ointment made with a drachm of creasote to two or three ounces of lard.

CROTON SEEDS AND OIL.

CROTONIS SEMINA. Seeds of *Croton Tiglium.*
CROTON OIL. Crotonis Oleum. Expressed oil of the seeds of *Croton Tiglium.*—(Ed. Phar).

Nat. Ord.—Euphorbiaceæ. *Sex. Syst.*—Monœcia Monadelphia.

Croton seeds are obtained from various species of croton, but chiefly from the *Croton Tiglium*—a tree from fifteen to twenty feet high, growing on the Indian Continent, in Ceylon, and in many islands of the Indian Archipelago. The nut or fruit, which contains three seeds, is somewhat larger than a hazel-nut, and of an oval triangular form. The seeds are about the size of French beans, resemble the castor-oil seeds in size and general appearance, and, when shelled, weigh on an average three grains each. They are of a brown colour, and odourless, with a taste at first mild and mucilaginous, but soon becoming hot and acrid. When heated they yield irritating fumes. Their thin brittle external shell envelopes an oleaginous albumen, which contains about fifty per cent. of a fixed oil. This, when separated by expression and purified by straining, constitutes the *croton oil* of commerce. It is extracted in London, as well as imported from India. It is thick, unctuous, and of a pale amber colour, with a faint peculiar odour, and the acrid taste of the seeds. It is nearly insoluble in pure cold alcohol, but completely soluble in boiling alcohol, sulphuric ether, and the fixed and volatile oils. The residuum from which the oil has been expressed is sometimes used in veterinary practice under the name of *croton cake ;* but as the amount of oil which it retains is very variable, its effects are irregular and uncertain.

The important constituents of croton-oil are albumen, gum, a mild fixed oil, and a volatile acid termed the crotonic. Croton oil contains only the last two of these ingredients. *Crotonic acid* is the active constituent of croton, and is crystalline, highly volatile, and intensely acrid when tasted, inhaled into the nostrils, or applied to the skin.

Impurities.—Croton seeds are not liable to sophistication. They should be plump and well shaped, and not dry or shrivelled. The oil is sometimes of inferior quality, and dark coloured, on account of the seeds from which it has been extracted being old or musty. It is occasionally adulterated with other oils, most commonly with castor-oil. This may, however, be discovered by agitating the suspected specimen in a phial, with its own volume of cold alcohol, which dissolves out the castor-oil, and thus, after standing for a short time, produces a sensible diminution in the volume of the impure croton-oil. This test is chiefly valuable when the admixture of castor-oil is considerable, for some genuine specimens of croton-oil are soluble in cold alcohol to the amount of nearly five per cent.

Actions and Uses.—Croton is an irritant poison ; and is used internally as a cathartic, and externally as a counter-irritant.

Forty seeds are sufficient to destroy a horse in seven hours, with all the symptoms of gastro-intestinal inflammation ; and I have frequently seen even full medicinal doses cause very unexpected and serious irritation. Orfila gave a dog three drachms, which proved fatal in three hours, the œsophagus being tied to prevent the expulsion of the poison by vomiting. Fatal effects are also said to have followed the administration of one drachm to the dog. The same quantity of the seed or oil which proves fatal when given to any animal internally, will have the same effect when placed underneath the cellular tissue, or applied to a wound. Thirty grains injected into the veins of a horse caused speedy death, and produced the same appearances as large doses given by the mouth, namely, redness and inflammation of the alimentary canal, especially of the stomach and lower intestines. The irritant action of croton is often exerted on those employed in shelling the seeds previous to the expression of the oil, frequently inducing swelling and inflammation of the face and other parts exposed to the croton dust. The cathartic action of croton is developed in all the higher animals. In the horse, its effects are prompt and powerful, but the great extent and extreme vascularity of the intestinal mucous membrane, requires that in that animal it should be used with much caution. In cattle practice it is invaluable, operating with certainty when most other purgatives are quite ineffectual, and being rarely attended with undue irritation or other bad consequences. In dogs and pigs, it is also equally prompt and effectual. In developing either its cathartic or poisonous action, which latter is but an exaggeration of the former, it probably induces a considerable amount of topical irritation wherever it comes in contact with the alimentary mucous membrane ; but, speedily mixing with the biliary and pancreatic juices, it is emulsified and perhaps saponified, and, like other fats and fixed oils, is probably absorbed through the villi into the lacteal vessels, and so carried by the thoracic duct into the general circulation, from which it is shortly excreted through the intestinal glandular apparatus in the same way as other purgatives. It acts on all parts of the alimentary canal, but according to some, most powerfully on the lower intestines. It operates more speedily than aloes, and generally produces more fluid discharges. Youatt and some other veterinary authors state that croton is uncertain in its effects ; but this is a mistake. They also object to it on account of its tendency to cause griping and debility. The former effect is, however, generally the result of its injudicious administration, and may be easily prevented by combining it with other medicines ; whilst the latter, although an occasional consequence in the human subject, very rarely occurs in the lower animals, and then only during the active operation of the dose, and in no greater degree than that produced by equally powerful purgatives.

Croton is used as an active cathartic for all the domesticated animals, commending itself chiefly by the full and speedy effects which it produces when administered in small quantity. It is given with great advantage in fardel-bound, and other forms of constipation in cattle; in torpidity of the bowels dependent on disordered states of the nervous system, as in tetanus in the horse, and congestive puerperal fever in cattle; and in cases where it is desirable to produce copious fluid evacuations, and to excite extensive counter-irritation, as in passive dropsies or local inflammation in parts remote from the alimentary canal. It is of much value where bulky medicines are inadmissible; where, for example, animals are restive, unmanageable, or unable to swallow from disease or injury, as in tetanus, bad bronchitis, and other affections of the throat. Croton in all its various forms is contra-indicated in every case where any portion of the alimentary canal is in an unusually irritable or vascular state. It is not, in general, suitable for very young or delicate subjects.

Croton-oil is sometimes used externally as a counter-irritant; and, as such, resembles tartar emetic in its action, speedily producing a crop of minute crowded vesicles, which soon assume the character of pustules. The eruption is attended by much irritation, inflammation, and swelling of the surrounding parts. When applied over a considerable surface, especially if the skin is thin or abraded, the oil becomes absorbed, and produces its usual action on the bowels. On this account, and also from its liability to excite undue irritation, and to involve the more deep-seated tissues of the skin, it is not a very suitable vesicant either for horses or dogs. But it is often useful for cattle, in which it is much less apt either to purge or to blemish. To prevent the injurious effects that might otherwise attend its absorption, it should never be applied to the skin in quantities larger than those in which it can be safely given internally, and should always be used diluted with some less potent substance. It is used as a counter-irritant in bronchitis, pneumonia, pleurisy, and chronic glandular enlargements in most animals; and in chronic rheumatism amongst cattle, in which I have frequently seen the affected joints much benefited by its repeated application at short intervals.

Doses, etc.—The dose of croton seeds, as a cathartic for the horse, is from ten to fifteen seeds; for cattle from fifteen to twenty; for sheep about four; for dogs, two; and for swine, four. The recollection of the proper dose of croton for any animal is much aided by knowing that one drachm of Barbadoes aloes is equivalent to two croton beans, or six grains of ground croton. The dose of the oil for the horse is from eighteen to twenty-four drops; for cattle about one-fifth part more; and for the dog from three to four drops. The dose of the so-called croton cake is generally considered as double that of the fresh croton bean. The cake, however, as has been above stated, is not an eligible form of medicine, on account of the uncertainty of its effects. The bruised seeds and the oil are generally administered made into a bolus with linseed meal or dissolved in linseed oil. Though generally used alone, they are sometimes mixed with other purgatives. Thus, in obstinate constipation, or torpidity of the bowels, among cattle, they are often advantageously given with a few scruples of calomel, and scarcely any purgative mixture is more effectual. Alcoholic solutions of croton, as usually made, are very faulty and unchemical preparations, for cold alcohol has scarcely any solvent action on pure oil of croton. Some practitioners, in using croton, drop it in an undiluted state on the tongue; but except in extreme cases this is not advisable, as the oil is apt to adhere to the tongue and fauces, causing irritation and inflammation. For external purposes the bruised seeds or the oil may be dissolved in six or eight parts of oil of turpentine or soap linament. Croton-oil added in small quantity to any of the ordinary blistering ointments greatly increases their activity.

DIGITALIS.

Foxglove. Leaves of *Digitalis purpurea.*

Nat. Ord.—Scrophulariaceæ. *Sex. Syst.*—Didynamia Angiospermia.

Digitalis or foxglove grows wild in this country and in many parts of the Continent. It is chiefly found on gravelly sandy soils, in young plantations, on hedge-sides, banks, and hill pastures. It is a herbaceous biennial plant, with numerous drooping, purple, spotted flowers, an erect stem several feet high, and large oval-shaped leaves with serrated edges, and covered with down, especially on their lower surfaces.

The leaves are the officinal part of the plant, and are gathered in June and July, just before the appearance of the flower. The leaves of the second year's growth are generally more active than those of the first. They are best dried in darkness, over stoves, and are then of a dull green colour, with little smell and a nauseous bitter taste. The seeds, which are recognised by the London College, are small, round, and of a grey colour. Though the *Digitalis purpurea* is the variety generally used, other species, in all probability, possess similar properties. The active principles of digitalis are readily soluble in water, alcohol, ether, and weak acids. The infusion and tincture, when diluted, give precipitates of tannogallate of iron, with a solution of the sesquichloride of iron. The leaves, when triturated with lime, evolve ammonia.

Digitalis contains lignine, starch, gum, and sugar, albumen, tannin, extractive and fatty matters, salts, and an active crystalline principle termed *digitaline*, which is neutral, colourless, bitter, and acrid, and present in the leaves in the proportion of somewhat less than one per cent.

Actions and Uses.—The physiological actions of digitalis are complex; but its uses are few and simple. It is a topical irritant, a sedative, and a diuretic.

Two ounces of the dried powdered leaves destroyed an adult horse in twelve hours. (Moiroud). One ounce, and in some cases six drachms of the leaves, given to horses in a bolus, caused, in from three to ten hours, loss of appetite, frequent urination, fluid feces, sometimes tinged with blood, a pulse at first full and increased, but afterwards small, slow, and irregular, blunting of the special senses, contraction of the pupils, difficulty of breathing, languor, and, after about twelve or sixteen hours, death. (Hertwig). Doses of about one or two drachms given to dogs cause nausea; and when vomiting is prevented, moaning and expression of abdominal pain, feebleness of the pulse, diarrhœa, general weakness, shivering, slight convulsions, contraction of the pupils, and diminution of common sensibility. As might be expected from such symptoms, inflammation and its consequences are found after death throughout most parts of the alimentary canal. Congestion of the lungs, a spotted appearance of the heart, occasionally injection of the membranes of the brain and spinal cord, and a fluid condition of the blood, are also observed. Digitalis produces its effects by whatever channel it enters the body; and appears to destroy life by poisoning the blood, obstructing the pulmonary circulation, and depressing the action of the heart. Its effects on the circulation, however, are not very uniform, being modified by various circumstances, especially by the dose employed. With large doses, the pulse becomes much accelerated, irregular, and intermittent. Thus, in one horse poisoned by digitalis the pulse rose to 130 beats per minute (Moiroud), and in another to 140 (Hertwig). In dogs large doses also raise the pulse to about 95, and often higher. But this stimulated state of the circulation is generally succeeded by a corresponding depression, the pulse becoming soft, irregular, and so slow, that in dogs, which had received poisonous doses, it numbered for some minutes before death only fourteen beats per minute. Small and repeated doses produce depression of the action of the heart in conjunction with nausea. Besides thus acting on the heart and circulation, digitalis is also a diuretic. But to ensure this effect without inducing its sedative action, it must be given in small and repeated doses, in combination with saline diuretics. It has a decidedly cumulative action. As a sedative in inflammatory diseases, digitalis, like opium and such other medicines, is of most value in chronic cases, and where the more acute symptoms have been subdued by other remedies. It appears to be useful in irritative fever, especially when depending on nervous disturbance ; in functional diseases of the heart ; and in chronic rheumatism. It has been given with some benefit for the relief of broken wind, and enters into the composition of Professor Dick's famous recipe, which consists of a drachm each of digitalis, calomel, opium, and camphor. Digitalis has been prescribed, but without much success, in epilepsy, phthisis pulmonalis, and externally in ulcerations and chronic eruptions. It should be avoided, on account of its irritant action, in inflammation of the digestive organs. Some practitioners speak highly of it as a diuretic, especially for the cure of dropsies ; but for this purpose its efficacy has been greatly over-estimated. In using digitalis, whether as a sedative or a diuretic, care must be taken to watch its action, and to diminish its dose gradually whenever its constitutional effects appear, otherwise its cumulative properties may lead to the development of poisonous symptoms. Should these unfortunately occur, they are best subdued by stopping the administration of the medicine, and giving diluents, with opium, and if necessary stimulants.

Doses, etc.—The dose of powdered digitalis for horses and cattle is from ℈i. to ʒij. ; for dogs from grs. ij. to grs. iv. When used as a sedative it should be given at least three times a day, and as a diuretic at least twice, and in combination with mineral diuretics. The powdered leaves are sometimes used, but the extract is more convenient. It may be easily prepared by taking any convenient quantity of the leaves, reducing them to a pulp in a mortar, expressing the juice, filtering and evaporating it to the consistence of an extract, either in a vacuum or in shallow vessels exposed to a current of air. The dose of this is about a fourth of that of the powdered leaves. An infusion and tincture are sometimes used.

ERGOT OF RYE.

Ergot. Spurred Rye. Ergota. An undetermined fungus, with degenerated seed of *Secale cornutum*.—(Ed. Phar.)

Nat. Ord.—Graminaceæ. *Sex. Syst.*—Triandria Digynia.

There is much difference of opinion regarding the nature and cause of ergot of rye; but in the following remarks I shall only briefly notice those views which appear at present to be most generally received. The earliest symptoms of the disease occur about the time of blooming, when the young seed is observed to be covered with a white powdery matter—the spores or seeds of a fungus—which gives the grain a mildewed appearance, arrests its natural growth, and causes its abortion. This aborted embryo gradually increases in size, passes out beyond the palæ or husk, becomes more and more deformed, acquires a purple or brown colour, and forms the ergot or spur. The spores just noticed, as the exciting cause of the disease, still cover the spur and other parts of the seed. They have been carefully examined by many observers, but especially by Mr Queckett, who considers them to be a new species of fungus, which he proposes to call the *Ergotætia abortifaciens*. The ergot, besides, bears on its summit a grey feathery appendix which was once considered a variety of fungus, but which the majority of competent authorities now believe to be the shrivelled remains of the stigma, anthers, and elevated pericarp of the aborted seed. The manner in which the disease propagates itself is not very evident. Most persons believe that the spores come into actual contact with the fructifying seed; whilst others suppose that they may engender the disease even when scattered on the soil on which the rye is growing. But besides the presence of the fungus, close, damp, still weather also appears essential to the development of the ergot, which prevails only in warm, wet seasons, and in undrained localities. The extent of injury done to the rye crop by ergot varies much; sometimes only a few grains in each head being diseased, sometimes scarcely one being altogether sound. The average number affected is from five to ten. Rye is unusually susceptible of the disease, being attacked more often, and to a greater extent than any other plant. All the *Graminaceæ*, however, are liable to it, and also, though in a less degree, the *Cyperaceæ* and the palms. Ergot of rye is brought chiefly from Germany, France, and America, and about thirty cwts. are said to be imported annually. (Pereira).

Properties.—Ergot of rye has a curved spurred appearance; varies in length from one-third of an inch to an inch and a half, and in breadth from one to four lines; is marked by two longitudinal furrows; and has at its apex a pale, grey coloured excrescence, very fragile, and easily rubbed off. It is usually covered by a white powdery dust, is dark violet coloured externally, and grey within. Its odour, especially when in powder, is dull and musty; and though at first of a sweetish taste, it is bitter and disagreeable when chewed. When dry, it is inflammable, hard, and brittle; when moist, or exposed for some time to the air, it is soft, darker in colour, and covered with a little acarus which eats the interior of the seed. Its internal structure, when examined by the microscope, is observed to be made up of cells, of which many are oleaginous. Its best solvent is water, with which it forms a bright scarlet acidulous solution, retaining the odour, taste, and physiological actions of the ergot, and precipitated by alcohol, alkalies, and strong acids. Boiling destroys the activity of the solution, by volatilising the active principle. Dr Wright gives the following analysis of ergot:[1]—

Thick white oil,	31·0
Fungin,	11·4
Altered starch,	26·0
Mucilage,	9·0
Gluten,	7·0
Ozmazome,	5·5
Colouring matter,	3·5
Salts, with phosphoric acid,	3·1
Loss,	3.5
	100·0

[1] Dr Wright's valuable paper on Ergot may be found in the Edinburgh Medical and Surgical Journal, vols. lii., liii., and liv.

The oil is separable from the other constituents by agitation with ether; and appears to contain, in a concentrated form, the poisonous as well as the medicinal properties of the drug. It is either the active principle of the ergot, or the vehicle which contains it. Since Dr Wright's investigations, the medicinal properties of the ergot have been ascribed by M. Bonjean "to an extractive matter, soluble both in water and alcohol." (Christison). The brown, acrid substance once called *ergotin*, and long considered the active principle of ergot, is now looked upon as a resinous colouring matter. The presence of hydrocyanic acid has been entirely disproved.

Impurities.—Ergot is not very liable to adulteration. It is said to be sometimes mixed with fictitious seeds made with paste or plaster of Paris, and coloured brown. It is more likely, however, to be of inferior quality from long keeping, especially if in powder, and from the attacks of insects. It should not be kept longer than two years; and should be excluded from the air, and preserved in closely stoppered bottles. Sulphur and camphor, which some mix with it, are of little avail in preventing its deterioration.

Actions and Uses.—Ergot of rye is a poison, but neither so powerful nor so certain in its effects upon the lower animals as on man. When given in single large doses, it causes local irritation of the parts with which it comes in contact, and subsequently affects the nervous system, especially the spinal chord. When given to dogs it produces vomiting, tenesmus, and after a variable but generally short time dulness, prostration of muscular power, and spasms, chiefly of the diaphragm. These effects are produced in small dogs by doses of from six to twelve drachms. Twenty-four drachms proved fatal to a terrier bitch in twenty hours. Horses and cattle are even less susceptible of the action of ergot than dogs; and very large quantities, indeed even several pounds, have been given to them, not only with impunity, but even without any very obvious effect.

When injected into the veins of the dog in quantities of from two to six drachms dissolved in several ounces of water, it causes, first, great excitement and excessive acceleration of the pulse; and then, after a variable time, depression, paralysis—especially of the hinder extremities—spasms, and coma. Death ensues, generally from paralysis of the heart, in from five minutes to two hours. When injected into the arteries it acts still more rapidly. If placed underneath the cellular tissue, or in contact with a recent wound, it causes much irritation and inflammation, the formation of fœtid unhealthy pus, and great depression of the vital powers.

When ergot is given for some time continuously, it produces somewhat different symptoms from those which follow its administration in single doses. Dr Samuel Wright, to whose admirable paper we have already referred, found that it caused in dogs and rabbits nausea, impaired appetite, a weak, irregular pulse soon becoming intermittent, diarrhœa, excessive fœtor of the secretions and excretions, paralysis, particularly of the hinder extremities, enlargement of the liver, contraction of the spleen, formation of tubercles both in the lungs and mesentery, impairment of all the senses, wasting, and general debility. It does not, however, as in man, cause gangrene of the extremities. A dog, which got from two to three ounces daily, survived for seven weeks, when it had consumed in all fifty-six ounces of dry ergot. All animals to which it was given—dogs, cats, and rabbits—showed great aversion to it, even when mixed with sound grain, or considerably diluted with water, and although pressed by hunger, would scarcely eat it of their own accord.

Much discussion has occurred, and much contrariety of opinion still prevails, concerning the power of ergot to induce contractions of the uterus, and expulsion of its contents. But amongst the lower animals it has certainly no power of producing abortion. It has been given in large and repeated doses to cows, bitches, cats, swine, and rabbits, in all stages of pregnancy, but without causing abortion. Dr Wright's experiments on this subject are very conclusive. He administered half an ounce of ergot to a terrier bitch five weeks gone with young (Experiment 37); and the same quantity to another bitch within a few days of pupping (Experiment 35); both animals carried their pups the usual time. He gave a bull-terrier bitch half an ounce daily during the last three weeks of pregnancy; but she also went her full time (Experiment 38). Its effects on ruminating animals, both during gestation and at other times, are always less marked than on dogs or cats. In the rabbit very large doses have been given without influencing the uterus. Two and three drachms respectively were administered daily to two female rabbits, from the day after impregnation until parturition, which occurred at the usual time. During the whole period the rabbits were to all appearance in a healthy state, and the young ones were born of good size, and well nourished. These experiments, and others which were attended with similar results, certainly justify the conclusion that amongst the lower animals ergot has no tendency to cause the expulsion of the contents of the uterus at any period of gestation, whether early or late, either when given by the mouth or the rectum, in single large doses, or for some time continuously. In such cases the usual physiological effects of the ergot are produced, and the general health of the mother may be so deteriorated as to cause the death of some or all of the fœtuses, but no special action on the uterus is observable.

Even when the natural period of parturition has arrived, and when labour has actually commenced, ergot is often given to the lower animals with little if any effect. The author has often given it both to cattle and bitches, in which the process of parturition was protracted, without causing any increase in the force or frequency of the labour-pains. The same has been observed by Dr Wright, though in some of his experiments on bitches he gave doses two or three times as great as those usually prescribed. He also laid open the parietes of the abdomen at various intervals after the administration of full doses of ergot, but without observing any uterine contractions. In fact, ergot has no more action on the uterus of the lower animals than any other substance which causes intestinal irritation; and whatever action it may occasionally have in accelerating parturition is owing, not to any special effect on the organ itself, but to the local irritation, tenesmus, and vomiting which so commonly succeed its administration. Those who place reliance on it as a parturient, recommend it when the throes are languid, and occurring at long intervals; when the animal has been in labour for some time; and when the os uteri is considerably dilated; but disapprove of it when there is any malformation either of the mother or the fœtus, when the position of the fœtus prevents its ready expulsion, and sometimes also in first pregnancies. An infusion of ergot is also a favourite remedy with many for bringing away the placenta. But if the ergot has no effect in expelling the fœtus, it can have none in expelling the fœtal membranes, which may, however, be very readily removed by the hand. I am not aware of ergot being given internally for any other purposes than those already mentioned. It is often, however, used externally as a styptic. Besides being effectual in most ordinary cases, a diluted solution may often be advantageously injected into the uterus to arrest the hemorrhage which, in veterinary patients, occasionally follows parturition. It is also useful in vaginal hemorrhage.

Doses, etc.—The usual dose of ergot, as a parturient for the mare or cow, is from ℥ss. to ℥i.; and for sheep, swine, and bitches, about ʒi. These doses are generally repeated at intervals of half an hour, until parturition occurs. It is usually given in the state of infusion which, during its preparation, must not be exposed to a boiling temperature. The *oil of ergot*, from its state of concentration, would be more convenient than any of the ordinary forms of administration. It has been successfully used in the human subject in cases of lingering parturition; and also externally as a styptic, and an anodyne in rheumatism and toothache.

ETHER.

Sulphuric Ether. Æther Sulphuricus. $C^4 H^5 O$ or Ae O.

Ether has now been known for upwards of three hundred years. It is always obtained from alcohol by depriving it of one equivalent of water, which is most easily and conveniently effected by the action of sulphuric acid. The Edinburgh College gives the following clear and explicit directions for its preparation :—

"Take of sulphuric acid, ten fluid ounces; rectified spirit, fifty fluid ounces; pour twelve fluid ounces of the spirit gently over the acid in an open vessel, and then stir them briskly and thoroughly; transfer the mixture immediately into a glass mattrass connected with a refrigeratory, and raise the heat quickly to about 280°. As soon as the etherial fluid begins to pass over, supply fresh spirit through a tube into the mattrass in a continuous stream, and in such quantity as to equal the volume of the fluid which distils over. This is best done by connecting one end of the tube with a graduated vessel, containing the spirit—passing the other end through a cork fitted into the mattrass—and having a stop-cock on the tube to regulate the discharge. When the whole spirit has been added, and forty-two fluid ounces have distilled over, the process may be stopped. Agitate the impure ether with sixteen fluid ounces of a saturated solution of muriate of lime, containing also half an ounce of lime recently slaked. When all odour of sulphurous acid has disappeared, pour off the supernatant liquid, and distil it with a gentle heat so long as what passes over has a density not higher than 735. More ether of equal strength may be obtained from the muriate of lime. And from the residuum of each distillation a weaker ether may be obtained in small quantity, which must be rectified by distilling it gently again."—(Ed. Phar.)

The essential ultimate change which occurs in the manufacture of ether is simply this. The sulphuric acid unites with the water of the alcohol, which has the composition $C^4 H^5 O + HO$; and the ether, $C^4 H^5 O$, thus set free being exposed to an elevated temperature, distils over along with water, a little alcohol, and a trace of sulphurous acid. It is to remove these impurities that the Edinburgh College directs the crude ether to be treated with chloride of calcium and quicklime, and redistilled.

Properties.—Sulphuric ether is a mobile, colourless fluid, having a peculiar etherial odour, and a warm, pungent taste, with a sensation of coolness. It is exceedingly volatile, and from its rapid evaporation, speedily reduces the temperature of any part to which it is applied. It boils at 96°, and freezes at 46°. As it is exceedingly inflammable, and forms explosive mixtures with air, much care should be used in approaching it with a light. It is miscible with alcohol in all proportions, and soluble in about ten parts of water. It readily dissolves many organic substances, but especially balsams and resins. Ether, when perfectly pure, has a density of 712; but that commonly sold is generally about 735. The Scotch ether is of lower density, and consequently stronger than the English or Irish.

Impurities.—Alcohol, water, and oil of wine, are the only impurities to which ether is liable. Any specimen containing the two former may be discovered by its increased density, or more certainly by its undergoing a diminution, exceeding five or six per cent., when agitated with a concentrated solution of chloride of calcium. When a little ether containing oil of wine is allowed to evaporate from the back of the hand, it evolves a peculiar odour, which the practised sense readily distinguishes from that of the pure ether. If such a specimen be gently distilled with water, the oil remains floating on the surface of the water.

Actions and Uses.—Sulphuric ether is stimulant, narcotic, and anæsthetic; and, when used externally, refrigerant.

Like other spirituous and etherous substances, it is rapidly absorbed, and acts on the nerves and nervous centres, and in large doses particularly on the brain, producing either great excitement or great depression, according to the dose and mode of administration. When given for a short while, it impregnates with its odour and taste the flesh and milk. Like most other volatile bodies, it appears to be excreted particularly by the lungs. In veterinary practice it is chiefly valued for its stimulant action, which, though transient, is prompt and powerful, and forms the physiological source of its activity as an antispasmodic. Its narcotic effects are readily observed when it is given to dogs or other small animals in considerable doses, and the preliminary stage of excitement, which is sometimes attended by convulsions, is generally very brief. Thus, when Orfila gave a dog four drachms, at the same time securing the œsophagus by ligature to prevent vomiting, he observed in about ten minutes inability to stand; and after fifteen minutes, complete insensibility, which continued, with occasional and partial awakenings, for about three hours, when death occurred. The coats of the stomach were found after death to be red, and much congested. (Christison on Poisons). The anæsthetic and narcotic actions of ether are closely allied; but the former is best developed by causing the medicine to be inhaled. Among the lower animals the anæsthetic effects of ether are tolerably easily induced, and are seldom attended by any evil consequences. A two-year-old thorough-bred filly experimented on by Mr Barron, of Newmarket, was fully etherized in four minutes, and continued in that state for about twenty-nine minutes, during which time the operation of neurotomy was performed on both fore limbs without the animal's evincing any pain. A donkey was fully affected in four minutes, another in five minutes, and a third in three minutes and a half; the latter remaining insensible to pain for about half an hour.[1] In these experiments, however, the effect seems to have been induced with unusual rapidity; and I have sometimes seen the exhibition of six, eight, and even ten ounces attended by only very imperfect action, even after the inhalation had been continued for some minutes. The refrigerant effect of sulphuric ether is only developed during its local application; and depends on its abstracting heat during its evaporation, which, on account of its volatility, is very rapid.

Sulphuric ether is distinguished from alcohol chiefly in the degree of its action, in the extreme rapidity and efficacy of its stimulant and antispasmodic effects, and in its possession of anæsthetic properties. Although resembling ammonia, it also differs from it in its acting particularly on the brain and cerebellum, and in its being attended by a greater amount of secondary depression.

It is much used as a powerful and prompt stimulant when nervous power is to be exalted or increased; and, though seldom effectual in removing causes of disease, it often counteracts violent and dangerous symptoms. It is generally useful in removing those shiverings which sometimes precede attacks of internal disease, and which indicate the operation of some depressing agency acting on the system through the skin. It speedily relieves colic, tympanitis, and stomach staggers, by overcoming that nervous derangement or torpidity on which these disorders usually depend. On account, however, of its active stimulating

[1] Veterinarian. 1847, pp. 146-8, and 197, 198.

properties, it must be withheld whenever these cases are accompanied by acute inflammation and high fever. In colic, asthma, and other spasmodic affections, it is advisable to combine it with opium—a combination which forms the most effectual of all ordinary antispasmodics. In inflammatory diseases of a chronic or sub-acute kind, and where there is much prostration of strength, or irritability depending on weakness, in all typhoid fevers, and in convalescence from exhausting diseases, ether is of much service, especially in cattle, often reducing the number and increasing the strength of the pulsations, and producing an amount of reaction favourable to the operation of tonics and other appropriate remedies. Any doubt which, in such cases, may arise with regard to the propriety of using the medicine, may be removed by observing its action on the pulse; and if this be improved by the first or second dose, it affords a decided indication in favour of the continued administration of the medicine. Ether is often effectual in the expulsion of intestinal worms, and especially of ascarides in the rectum, which may usually be dislodged by giving it in a state of considerable dilution as a clyster. In this form it is also often useful in relieving spasmodic affections of the intestines. The administration of ether must always be avoided where there is undue excitement, inflammatory fever, or sthenic inflammation. Ether is never used as a narcotic, and very rarely as an anæsthetic. As such, however, it is useful in the same cases in which chloroform is generally employed; and its effects are most conveniently developed by pouring the fluid on a sponge placed in the bottom of a nose-bag, perforated with holes for the admission of a sufficient quantity of air, and attached to the patient's head. It forms a very good refrigerant, but is too expensive to be much used in that way in veterinary practice. It is sometimes used as a solvent for oils, resins, balsams, neutral crystalline organic bodies, and gun-cotton, with which it forms the adhesive solution known as collodion. (See next page).

Doses, etc.—The dose of ether, as a stimulant for horses and cattle, is f℥i. to f℥iij.; and for dogs, about fʒi.: as an anæsthetic for the larger animals, f℥iij. to f℥vi.; and for the less, fʒiv. to fʒvi. When used as a stimulant it is given with water, which, to prevent the volatilizing of the ether, should be cold, and, if thought necessary, sweetened with sugar or treacle, or flavoured with aromatics. Diluted with twice its volume of rectified spirit, it constitutes the *spiritus etheris sulphurici* of the shops, and corresponds to the nostrum known as the sedative liquor of Hoffmann. Ether, on account of its transient effects, must be administered at least every hour, until some permanent good is produced; and as the system gradually becomes less susceptible of its action, the doses, when it is given for some time continuously, must be increased.

Collodion is a solution of gun-cotton in ether. The first and most difficult step in its manufacture is the preparation of the gun-cotton, which may be readily made by the following process, kindly communicated to Dr George Wilson by Mr Macfarlan, pharmaceutical chemist, Edinburgh :—" Take of clean dry cotton one ounce; powdered nitrate of potash fourteen ounces; and rectified sulphuric acid fifteen fluid ounces. Mix the acid and the nitre in a basin, which should be in a cool place, and exposed to a current of air; add the cotton little by little; press and stir the mixture; and prevent as much as possible the escape of nitrous acid fumes, by covering it up with a basin, or other convenient article. Allow the whole to stand for about two hours, and wash well with cold water." The process, if well managed, should yield about twenty ounces of gun-cotton soluble in ordinary ether. The cotton so prepared is then dissolved in sixteen parts of ether, some manufacturers also adding one part of rectified spirit. This is collodion. It is clear and colourless, and evolves a strong odour of ether. When it is applied to the skin, the ether evaporates, leaving a fine film of cotton, which, by repeated applications of the solution, at intervals of a few minutes, may be rendered sufficiently thick to protect wounds from the action of the air, or other causes of irritation. It has hitherto been used only in human medicine, and, though a very convenient substitute for sticking-plaster, sometimes causes a good deal of irritation, owing to the topical action of the ether.

EUPHORBIUM.

Concrete resinous juice of undetermined species of *Euphorbia*. —(Ed. Phar.)

Nat. Ord.—Euphorbiaceæ. *Sex. Syst.*—Dodecandria Trigynia.

The croton and castor-oil plants both belong to the natural family *Euphorbiaceæ*. The cactus-like plants yielding the medicinal euphorbium grow in the kingdom of Morocco. When incisions are made into the cortical part of their angular, jointed, prickly stems and branches, an acrid, milky, resinous juice exudes, and concretes into irregular, dull-yellow tears about the size of a pea, often hollow, and perforated with little holes. The dried juice is brittle, with an acrid and persistent taste, without odour, and, in a state of fine division, so irritating that those who collect it are obliged to cover their mouths and nostrils with cloths. In powder, it is grey, and insoluble in water, but its resinous principle dissolves in alcohol. When heated, it melts, swells up, and burns with a pale flame, and an agreeable odour. It contains from 37 to 60 per cent. of resin, which is its active ingredient; and from 14 to 19 per cent. of wax, a little caoutchouc, and various salts. As it contains no gum, it ought not to be called a gum-resin.

Actions and Uses.—Euphorbium is one of the most powerful vegetable irritants. When introduced into the stomach or cellular tissue, rubbed on the surface of the skin, inhaled into the nostrils, or applied to any other mucous membrane, it speedily causes violent and often fatal inflammation. Two ounces given internally destroyed a horse, with all the symptoms of gastro-enteritis; and four drachms retained in the stomach of a large dog had the same effect in about twenty-six hours. Inflammation of the intestines, with occasional patches of little ulcers, are the usual post-mortem appearances. So intensely irritating, indeed, is the action of euphorbium, that the workmen employed in grinding it are obliged to wear masks or handkerchiefs over their faces, and, in spite of all precautions, often suffer severely from headache, inflammation of the eyes, and sometimes even delirium.

When applied externally, it produces an abundant crop of inflammatory pustules. It is used to increase the potency of many blistering applications, but is apt, especially in horses and dogs, to destroy the deep-seated parts of the skin, and so prevent the future growth of hair. On this account, it should not amount to more than one-fourth part of the active ingredients of any counter-irritant used for either horses or dogs. For cattle, however, it may with impunity be applied in larger quantity. Unlike cantharides, it has no tendency to act on the kidneys.

FENNEL.

Fœniculum. Fruit of *Fœniculum Officinale.*

Nat. Ord.—Umbelliferæ. *Sex. Syst.*—Pentandria Digynia.

Fennel is an oval-shaped fruit, about the size of the coriander, consisting of two symmetrical halves, having a pleasant aromatic taste and an agreeable spicy odour, especially when moistened. Like the seeds of the other umbelliferous plants, its most important constituent is a volatile oil. It is stomachic and carminative, and was once much used for these purposes, and also for imparting an agreeable flavour to other medicines. It is given in the same doses as anise or cardamoms, which are commonly used instead of it.

GALLS.

Gallæ. Excrescences of *Quercus Infectoria*, formed by *Diplolepis Gallæ Tinctorum.*—(Ed. Phar.)

Nat. Ord.—Amentaceæ. *Sex. Syst.*—Monœcia Polyandria.

Galls, or gall-nuts, are morbid excrescences formed on the branches of a small shrubby species of oak, and caused by punctures made in the young branches by a small insect, which takes this method of depositing its larvæ. From the irritation thus produced, the punctures become surrounded by woody matter; and within this the insect passes through the various stages of its growth, until, about the month of July, it becomes a perfect fly. This is the time when the galls ought to be gathered. Galls are imported to this country from Aleppo, Constantinople, and the East Indies. They vary from the size of a pea to that of a walnut; are round, hard, smooth, and studded with tubercles; are of a bluish-grey colour externally, and yellow within. In their interior is a hollow in which the insect may generally be found. Sometimes, however, the central hollow is empty, from the death of the insect, or from its escape in a perfect form, when a small hole may be found, through which the creature has liberated itself. Such galls may be distinguished from those which still contain the insect, by the larger internal hollow, the presence of the hole through which the fly has escaped, the duller appearance, want of tuberosities, low density, and light colour, on account of which they are termed *white galls*. They are less astringent than the other sort, which, from their darker colour, are called *blue galls*. Galls are easily reduced to a yellow-grey powder devoid of odour, but having a powerful astringent taste. They yield their properties to water and proof spirit, forming with the latter the dark-red tincture of galls. The watery solution forms, with persalts of iron, the dark-blue or black solution of the tannate and gallate of iron, or ink; and, with a solution of gelatine, a grey floculent precipitate of tanno-gelatine—the essential principle of leather. These reactions, as well as the other important properties of galls, depend on the presence of about sixty-five per cent. of tannin or tannic acid, which is associated with 10·5 of fibre, 11·5 of moisture, 5·8 of gum, sugar, and starch, 4· of gallic, ellagic, and luteo-gallic acids; together with extractive matter, chlorophyll, volatile oil, albumen, and salts (Guibour).

Actions and Uses.—Galls are powerfully astringent, occupying, as regards activity, a mediate place between pure tannin and oak-bark. They are of much service in treating chronic mucous discharges, especially those depending upon relaxation and want of power; in relieving passive hemorrhages; and as antidotes for poisoning by tartar emetic, and vegetable alkaloids. They are farther used externally for all the purposes of styptics and topical astringents.

Doses, etc.—The dose of powdered galls for the horse is from ʒiv. to ʒvi.; for cattle, ℥i. or ℥ij.; for sheep and swine, from ℈i. to ʒi.; for dogs, grs. v. to grs. x.; and for cats, from gr. i. to grs. iij. Various forms of administration are adopted. The simple powder may be made into a bolus with any ordinary excipient, or dissolved in warm water or proof spirit. A tincture of convenient strength may be made by digesting or percolating together three ounces of powdered galls and a pint of proof spirit The tincture should be diluted and sweetened as required. For external purposes the following preparations are in use,—the simple powder, infusions of various strengths, and an ointment made with one part of powdered galls to four of lard, and to which half a part of opium may sometimes be advantageously added.

TANNIN or TANNIC ACID is the principle to which oak-bark, oak-galls, and most other vegetable astringents owe their characteristic properties.

"To obtain it, coarsely powdered nut-galls are acted on, in an apparatus of displacement, by ether, free from alcohol, but saturated with water. When the ether, after being left some time in contact with the powder, is allowed to drop into the lower vessel, it separates into two strata of liquid, the lower of which is a pure solution of tannic acid in water, which is drawn off and dried up after being washed with ether. The dry mass is redissolved in water, and again dried up in vacuo."—(Gregory's Hand-Book of Organic Chemistry, p. 267).

It is a soft, spongy, whitish-yellow, uncrystallizable, odourless substance, with an intense astringent taste, but devoid of bitterness. It is soluble in water, and sparingly so in alcohol. The solution gives a dark-blue or black colour with per-salts of iron, and a grey flocculent precipitate with gelatine. It is also precipitated by the vegetable alkaloids and mineral acids. It is a tribasic acid, and consists of $C^{18} H^5 O^9 + 3HO$.

Actions and Uses.—Tannin is the most powerful of vegetable astringents. When given internally it diminishes the mucous secretions, whether healthy or morbid, and causes especially dryness, and sometimes even thickening, of the intestinal mucous membrane. It appears to be converted in the body into gallic acid, which communicates to the urine a brown colour, and the characteristic reaction with salts of iron. Its uses are the same as those of galls and of oak-bark; but, from its concentrated form, it is often specially suitable as an internal astringent.

Doses, etc.—It is given to horses and cattle in doses of from ℈i. to ℈iij.; and to sheep and dogs, from gr. i. to grs. iij. It is used either in the form of pill, infusion, or tincture.

Gallic Acid.—When tannin is exposed for some time to air and moisture, it becomes converted into gallic acid. The method usually adopted is to exhaust, by decoction, all the astringent matter of galls, and place the decoction, for about four months, in covered vessels, kept at a temperature of 100°. The impure gallic acid thus obtained is repeatedly washed, dried, dissolved in boiling water, digested with animal charcoal, and crystallized. Another and more speedy method of preparation consists in boiling the tannic acid with excess of sulphuric acid. Excess of alkali has a similar effect. (Gregory). The conversion of tannic into gallic acid is usually believed to depend upon a process of oxidation, each equivalent of tannic acid ($C^{18} H^5 O^9 + 3HO$) combining with 8 of oxygen, and forming 2 equivalents of gallic acid ($2[C^7 H O^3 + 2HO]$), 4 of carbonic acid ($4CO^2$), and 2 of water ($2HO$). But this explanation is only applicable to the first method of preparation, and does not satisfactorily account for the conversion of tannic into gallic acid, by the action of sulphuric acid or alkalies.

Gallic acid occurs in delicate silky prisms of a pale yellow colour, and a sweetish acid taste. It is more soluble in alcohol than in water, which dissolves it very sparingly. It produces a black-coloured solution with per-salts of iron, but is not precipitated by gelatine.

Its actions and uses are analogous with those of tannin ; but, from its not combining with gelatine or albumen, it is less powerful as a topical astringent. It is given in the same or somewhat larger doses.

GELATINE.—GLUE.

Nitrogenous matter extracted by the action of boiling water from animal membranes.

Gelatine is usually obtained from bones, cartilages, tendons, or skin ; and is believed to be formed from these tissues by the breaking up of their albuminous materials, under the conjoined action of heat and moisture. The ordinary gelatine of the shops is chiefly made from bones, which are cleaned and boiled to remove fatty matters, and then crushed or steamed in a partial vacuum until a gelatinous fluid is obtained. Glue, which is a coarse variety of gelatine, is made by boiling the parings of hides and horns ; and *isinglass*—a pure, colourless gelatine—is obtained from the swimming bladder of the sturgeon. Gelatine when dried is hard and tough, varies in colour according to its purity, and forms, when dissolved in a limited quantity of water, a viscid tremulous mass.

Actions and Uses.—Unless given with albuminous and starchy matters, gelatine is very indigestible, and quite inadequate to healthy nutrition. Animals restricted to it for any considerable time die of utter inanition. Along with other proximate principles, it appears, however, to be a useful article of diet, both for men and dogs, especially during recovery from acute disease, when it probably affords materials for the repair of the bones and other gelatinous tissues. It is an effectual demulcent ; but is apt to become hard and dry, and hence is not very suitable for forming a permanent sheathing for irritable surfaces. The coarse impure gelatine or glue is often employed in veterinary practice for securing the horns of cattle, and for making adhesive plasters. For this latter purpose two pieces of stout cloth are cut so as to leave a number of tails with uncut margins of several inches, and are smeared with melted glue, and applied one on either side of the wound, and with the uncut margins overlying for some inches. When the plaster is dry, these approximating uncut margins are sewed together. Very large wounds may be thus easily secured. Glue plasters are also often effectual in reducing and retaining umbilical hernia, both in calves and foals; and in these, as in all other cases, the chief requisites for applying them securely are to cut the cloth into ribands or tails, to smear both the cloth and skin with the melted glue, and to keep the plaster smooth and firm until it be thoroughly dry. In pharmacy, gelatine has been used instead of paper, as a neat and cleanly envelope for boluses.

GENTIAN.

Gentiana. Root of *Gentiana lutea.*

Nat. Ord.—Gentianaceæ. *Sex. Syst.*—Pentandria Digynia.

The *Gentiana lutea* or yellow gentian has a perennial root, and an annual herbaceous stem, which rises three or four feet in height, and bears numerous yellow flowers. It abounds in most parts of temperate Europe, thrives best between 3000 and 5000 feet above the level of the sea, and is extensively cultivated in the mountainous districts of the Alps, Vosges, and Pyrenees. All parts of the plant are bitter and tonic, but the root alone is used in medicine. It is brought to this country in bales, chiefly from Switzerland, by way of Marseilles and other Mediterranean ports. It usually occurs in pieces varying from a few inches to a foot in size; is branched, rough, and surrounded by circular ridges; and has a yellow brown colour and ligneous structure externally, but a lighter tint and more spongy texture within. When moist it is tough and flexible, but when dry is brittle and easily pulverised. It has a peculiar aromatic and rather disagreeable odour; and a taste at first sweetish, but afterwards strongly and permanently bitter, but without astringency. When powdered it has a yellow colour with a shade of brown, and readily yields its bitterness to water, alcohol, and ether.

"Gentian consists of a bitter extractive matter, gum, uncrystallizable sugar, a principle analogous to bird-lime (consisting, according to later investigations, of wax, oil, and caoutchouc), concrete oil, a yellow colouring principle, a trace of volatile oil, and a peculiar acid named gentisic acid. Some chemists thought they had succeeded in separating, by means of ether, an active neutral crystalline principle of a yellow colour, in which the bitterness of the root is concentrated. It appears, however, that the active principle has not yet been isolated." (Neligan).

The root of the *Gentiana lutea* is occasionally mixed with that of various other plants of the same natural family; but this is of little importance since they are all possessed of similar properties. Other roots of a different and sometimes poisonous action are also occasionally mixed with the gentian. Such are monkshood, belladonna, and white hellebore, which may, however, be distinguished by the absence of the pure bitter taste and bright yellow colour so characteristic of true gentian. The powder, especially that met with abroad, is said to be occasionally adulterated with yellow ochre, which, however, may be easily detected by heating the suspected specimen with a little sulphuric acid, filtering the solution, and testing for iron.

Actions and Uses.—Gentian is a pure and simple bitter, and is consequently a stomachic and tonic. It is probably the best of all bitters, and some consider it little inferior to cinchona as a tonic. Narcotic properties have been ascribed to it; but no such effects follow its administration to veterinary patients. Horses have received from four to twenty-four ounces, and dogs from two to four ounces, repeated during several days, without evincing the slightest symptoms of narcotism. It is administered in many chronic complaints, and in convalescence from debilitating disease, acting beneficially as a stomachic and general tonic. It is useful in cases of simple indigestion, especially in young animals; and, from its bitterness and its laxative tendency, is often effectual in expelling intestinal worms. Some practitioners still recommend it in jaundice and sheep-rot; and in such cases it is probably of some service when used, as it generally is, along with other remedies. Like other tonics, it is contra-indicated in irritation of the intestines, and in acute inflammatory diseases. In the form of an infusion it is occasionally applied externally as a mild stimulant and antiseptic.

Doses, etc.—The dose for the horse is from ʒiv. to ʒviij.; for cattle, from ℥i. to ℥ij.; for sheep, ʒi.; and for dogs, ℈i. These doses may be given twice or thrice a day, either alone or with a small quantity of ginger, cardamoms, or some other tonic. For horses and dogs it is generally made into a bolus with syrup or some other excipient; and for cattle is used as an infusion or tincture. The infusion may be conveniently made by macerating together two ounces of gentian, a pint of water, two ounces of proof spirit to facilitate solution, and two or three drachms of cardamoms or caraways as flavouring ingredients. After maceration for a day or two, the whole may be strained through linen or calico. A tincture may be prepared with the same ingredients, substituting only proof spirit for water, and using either the process of digestion or percolation. An extract, though recommended by some authorities, is troublesome to prepare, and of little use in veterinary practice.

GINGER.

Zingiber. Rhizome, or underground stem of *Zingiber officinale*.

Nat. Ord.—Zingiberaceæ. *Sex. Syst.*—Monandria Monogynia.

The *Zingiber officinale*, long known as the *Amomum Zingiber*, is grown in many warm climates, but especially in the East and West Indies. Its rhizome is biennial, creeping, fleshy, and nodulous, and gives off numerous descending short radicles, with several ascending annual stems, which reach to the height of three or four feet, are invested with smooth sheathing leaves, and terminated by a spike of purple flowers. The rhizomes used for making green or preserved ginger are gathered when about three months old, and while still soft and juicy. For other purposes they are taken up when about a year old, and while still plump and soft.

Properties.—The black and white gingers are the chief commercial varieties. Both are believed to be obtained from the same plant, and the difference in their appearance depends chiefly on the manner in which they are prepared for use. The black gingers are cleaned, but without the removal of the external skin, are immersed in hot water, and dried; while the white are first peeled, and then dried, without being moistened. The former are covered by a dark-brown wrinkled epidermis, and have a tough fibrous structure; the latter are destitute of epidermis, lighter in colour, of a soft starchy texture, and usually of superior quality. Both varieties are met with in hard, knotty pieces from two to four inches in size. When broken across they have a marbled appearance, the outer parts being somewhat resinous, and the inner starchy and fibrous. They have a strong agreeable aromatic odour, and a warm pungent taste, and dissolve in water and alcohol of all densities.

Impurities.—The drug-merchant sometimes attempts to give the inferior varieties the light colour of the finer Jamaica ginger by exposing them to sun-light, to sulphurous acid, or to chloride of lime, but such bleaching processes cannot impart the soft resinous structure, aromatic odour, and compact symmetrical form which distinguish good ginger. In the following analysis by Bucholz, the two first constituents should be specially noticed as the active principles of the medicine:—Pale yellow volatile oil 1·5; aromatic, acrid, soft resin 3·6; extractive matter 11·; starch 19·; gum, bassorin, and mucilaginous matters 46·; woody fibre 8·; and water 11·.

Actions and Uses.—Ginger is slightly irritant, stomachic, carminative, and mildly tonic. It stimulates the various mucous membranes with which it comes in contact. If blown into the nostrils it promotes the nasal discharge, and if chewed augments the flow of saliva. When administered internally in repeated doses, it increases the gastric secretions, facilitates digestion, and prevents the formation of flatus. From these stomachic and carminative properties, and from its action as a mild vegetable tonic, it is a useful remedy during convalescence from debilitating diseases, especially when accompanied by atony of the digestive organs. It is, besides, a valuable adjunct to many kinds of medicine, and, when conjoined with purgatives, diminishes their tendency to nauseate and excite griping, while it also somewhat expedites their action. To fulfil these purposes it is used for all domesticated animals, and especially for cattle and sheep.

Doses, etc.—The dose of ginger for the horse is about ℥i.; for cattle, from ℥ij. to ℥iij.; for sheep, about ʒij.; and for dogs, from ℈ij. to ℈iij. It may be made into a bolus with any suitable excipient, or dissolved in hot water, the solution being either given alone or sweetened with treacle or sugar. The tincture is too expensive for ordinary use in veterinary practice, but is highly spoken of by Mr Morton, who recommends it to be made with two ounces of ginger to every pint of proof spirit. Such a tincture, however, speedily becomes turbid and unsightly. A much better preparation may be made with four ounces of ginger to a pint of rectified spirit,—macerating the solution for a few days, straining and diluting it as required.

GUM ARABIC.—GUM TRAGACANTH.

Gummi Acaciæ. Gum of various species of *Acacia.*

Nat. Ord.—Leguminosæ. *Sex. Syst.*—Monodelphia Polyandria.

Gummi Tragacanthæ. Gummy exudation of *Astragalus verus* and other Species.

Nat. Ord.—Leguminosæ. *Sex. Syst.*—Diadelphia Decandria.

Gum is a large constituent of many plants, but for commercial and medicinal purposes is chiefly got from various species of *Acacia.* These are trees usually of medium size, with a stunted, weathered aspect, a grey bark, oblong linear leaflets arranged along either side of the stalk, and a moniliform fruit resembling the laburnum. They abound in dry, warm climates, especially on the African continent, and are most prolific when old and stunted, and during dry, hot seasons. In the warm months of June and July a viscid juice exudes from natural cracks or artificial incisions in the bark, and concretes by the heat of the sun into little round masses or tears, which are of a yellow or brown colour, have a density varying from about 1100 to 1300, no odour, and a bland sweet taste. They dissolve in water, forming an adhesive viscid fluid. The colour and transparency of gum are liable to many variations, being sometimes different in specimens obtained from the same tree; and sometimes identical in those from different species.

Gum Acacia, or Gum Arabic—the most important medicinal variety—is chiefly brought from Africa, and not from Arabia, as its name might indicate. When imported, it is picked, sorted, and separated, usually into three different qualities, distinguished by the size, colour, and transparency of the tears. It is tough and difficult to powder, but must not be triturated in iron mortars, as it is apt thereby to become acid and discoloured. When pure, it is soluble in its own weight both of hot and cold water, and also in vegetable acids. It is insoluble in alcohol, ether, and oils; and is decomposed by mineral acids. Sulphuric acid, with the aid of heat, converts it into a variety of sugar called mannite; and nitric acid into mucic and oxalic acids. It consists of 17·6 per cent. of water, 3· of ashes, and 79·4 of a pure gummy principle termed Arabin. Its ultimate analysis is $C^{12}\ H^{11}\ O^{11}$. It may be distinguished from the other gums (which are occasionally substituted for it) by its being almost colourless, quite transparent, rough in appearance, brittle, but tough, and easily and perfectly soluble in water. Its adulteration with starch may be detected by iodine. Its yellow colour may be almost entirely removed by exposure to sunlight.

Gum Senegal is very similar to gum arabic, but is less brittle, and dissolves only in four or five parts of water. The *East Indian Gums* are less valuable than either of the two varieties noticed, being dark coloured, and more difficult of solution. The gums of Australia and the Cape, now imported in considerable quantity, are also considerably inferior to gum arabic in colour, transparency, and solubility.

Gum Tragacanth is derived from shrubs or small trees belonging to the genus *Astragalus;* occurs in thin, semi-transparent, lamellæ or plates of a white-grey or yellow colour, and marked with concentric ridges; and is tasteless, odourless, and very tough. Cold water causes it to swell into a sort of jelly, but boiling water readily dissolves it, forming a dense and viscid mucilage. It contains 53·3 per cent. of arabin; 33·1 of an insoluble gummy principle called bassorin; 11·1 of water; and 2·5 of ashes.

Actions and Uses.—Gums, though perhaps the least nutritive of all the non-nitrogenous or calefacient articles of food, are superior to most of these articles as demulcents and emollients. When dissolved in water, they are often serviceable in diarrhœa, whether caused by purgatives, poisons, or other irritants; as injections in inflammation of the kidneys and bladder; and as applications for dry, painful, and abraded surfaces. In all such cases, they afford a mechanical investment for injured or inflamed parts, and so protect them from the action of irritants. They are used for making emulsions, electuaries, and boluses; but have the disadvantage of speedily becoming dry and hard.

Doses, etc.—The dose of gum for horses and cattle is from ℥i. to ℥ij.; for foals, calves, and sheep about ʒiv.; and for dogs, from grs. xv. to grs. xl. It is best given in the form of mucilage, which is made by dissolving one part of gum in two of cold water, and straining the solution through linen or calico. When used in cases where there is much irritation, it is often conjoined with laudanum, and where there is relaxation, with catechu, chalk, or alum.

HELLEBORE.

Helleborus. Underground stem and root of *Helleborus niger*.

Nat. Ord.—Ranunculaceæ. *Sex. Syst.*—Polyandria Polygynia.

The *Helleborus niger*, or Christmas Rose, is indigenous to many parts of Continental Europe, and is often cultivated in this country. It is a herbaceous plant, from one to two feet in height, with numerous digitated, dirty-green leaves, with flowers which appear in January and February, and with a perennial, black, scaly root-stock, from which descend numerous dark coloured radicles, about the thickness of a quill, having a faint, unpleasant odour, and an acrid, bitter taste, and constituting the officinal part of the plant. There is no satisfactory analysis of hellebore. At present, its active principle is believed to be a volatile acid united with an acrid oil.

Actions and Uses.—In large doses it is an irritant poison, producing gastro-intestinal inflammation. Two drachms given internally, destroy a medium-sized dog in a few hours, and much smaller quantities have proved fatal in a shorter time, when applied to a wound. (Christison). Quantities of from two to three drachms produce in horses colic, enteritis, and death in from forty to fifty hours; and from one to three drachms induce similar effects among sheep and goats. (Hertwig). It acts in all animals as a purgative and anthelmintic; but is so violent and unmanageable that it has been entirely superseded by other medicines. For the dog, it is an emetic; but, as such, it has also deservedly fallen into disrepute. It is used externally for the same purposes as veratrum album, namely, as an irritant for promoting discharges, and as a constituent of blistering ointments. But unless used cautiously, and in small quantity, it is inconvenient and hurtful, on account of its liability to become absorbed, and its tendency to act with unexpected violence, and thus cause blemishing.

HEMLOCK.

Conium. Leaves of *Conium maculatum.*

Nat. Ord.—Umbelliferæ. *Sex. Syst.*—Pentandria Digynia.

Hemlock grows wild in all parts of this country, and is a biennial plant which, when one year old, has a small slender root, and a few leaves lying flat on the ground. During its second year's growth, when the plant is usually collected for use, the root is large, white, and fusiform ; the flowering stem is from two to five feet high, hollow, jointed, smooth, and thickly covered with purple spots ; the leaves are large, cut into segments, and have a bright green colour, a nauseous, bitter taste, and a strong, peculiar odour, which is characteristic of all parts of the plant, and aptly compared to that of mice ; the flowers are small, white, and, like those of the other plants of the family, arranged in umbels or clusters ; the fruit resembles that of the anise, is round, ridged, of a brown colour, devoid of hairs, more active than the leaf, and less apt to lose its energy by keeping.

The leaves are the chief officinal part of the plant, and may be gathered at almost any season. They are rapidly dried in stoves at a temperature of about 120°, and preserved in bottles or jars excluded from light. As they gradually lose their activity, they should not be kept for more than two years. They readily communicate their properties to water, alcohol, fats, and oils. When exposed for a short time to a heat of 212° (or upwards), their active principle is decomposed, and hence all preparations of hemlock which have been subjected to such a temperature are nearly inert. When the leaves are strongly heated, there is produced a powerfully narcotic empyreumatic oil, similar to that got by the same method from hyoscyamus. Hemlock contains albumen, resin, colouring matter, odorous volatile principles, and a volatile oleaginous alkaloid called *conia*, which, when liberated by distilling the leaves with potash, is transparent, oily, and colourless, but soon becomes brown when exposed to air and light. It has an intense suffocating odour of mice, a peculiar acrid taste, is sparingly soluble in water, but readily dissolved by alcohol, ether, and dilute acids. Its formula is said to be $C^{16}\ H^{16}\ N$.

The leaves of hemlock are liable to admixture with those of other plants. This can only be detected by knowing accurately the botanical characters of the hemlock, and especially the odour, taste, colour, and form of the leaf. A tolerably accurate estimate may be made of the goodness of a specimen of hemlock, or of any of its preparations, by observing the intensity of the odour of conia developed when the specimen is triturated with aqua potassæ.

Actions and Uses.—The conflicting accounts of the actions of hemlock chiefly depend on its different effects on the various classes of animals, and on the variable activity of its preparations. It acts in most animals as a peculiar narcotic poison, causing general paralysis, and death by asphyxia. But, like all such narcotic vegetables, it has little effect on the larger ruminants. Hertwig gave a cow the fresh two-year-old herb in quantities varying from six ounces to three pounds, without any other effect than slight hoven. He also mentions that a year-old ram, which got nothing but hemlock for five days, consumed it without much reluctance, and suffered no bad consequences. Horses also have got doses of four pounds with the same negative results. Moiroud, however, poisoned a horse with half a pound of the dried leaves given as a decoction, and observed nausea, spasmodic contractions of the muscles of the extremities, cold sweats, dilation of the pupils, and dulness. Hemlock acts with much greater energy on dogs, cats, and all carnivora. Professor Christison gave an extract, made from the leaves, to dogs, and found that an ounce, when swallowed, proved fatal in forty-five minutes; ninety grains, when applied to a wound, had the same effect in an hour and a half, and 28 grains in two minutes when injected into the veins. It acts by whatever channel it can be absorbed, and produces palsy, first affecting the voluntary muscles, and by and by the diaphragm and other respiratory muscles, thus causing death by asphyxia. Twitching of the extremities and slight convulsions sometimes also occur, but no topical irritation, nor any narcotism, or impairment of common or special sensation. Judging from its symptoms, it appears to paralyse the motor tract of the spinal chord.

Hemlock has been used medicinally as a calmative in rheumatism and neuralgia, as a deobstruent and diuretic, and externally as an anodyne. But its curative actions have as yet been very imperfectly studied.

Doses, etc.—The dose of the dried leaves for horses or cattle may be about ℥ij.; but from the slightness of its physiological action it is not likely to be of much curative value in these animals. The extract, which is the most convenient preparation is given to dogs in doses of grs. ij. to grs. v.

From carelessness in drying the leaves, or in concentrating the expressed juice, the extract is often quite inert. By attending, however, to the following directions, an active and well-keeping preparation may be got:—

"Take of conium any convenient quantity, beat it into a uniform pulp in a marble mortar, express the juice, and filter it. Let this juice be evaporated to the consistence of a very firm extract, either in a vacuum with the aid of heat, or spontaneously in shallow vessels exposed to a strong current of air, freed from dust by gauze screens. The extract is of good quality only when a very strong odour of conia is disengaged by degrees, on its being carefully triturated with aqua potassæ."—(Edin. Phar.)

A good tincture may be prepared in several different ways, but especially by expressing the juice, and adding to it about a fourth part of rectified spirit. *Conia* is a very active poison, being almost as powerful as anhydrous prussic acid. It causes at first local irritation, which, however, is speedily superseded by swiftly spreading paralysis, which proves fatal by arresting respiration. One drop applied to the eye of a rabbit caused death in nine minutes; three drops and a half placed on the conjunctiva of a cat had the same effect in a minute and a half; and five drops when swallowed by small dogs began to operate in thirty seconds, and destroyed life in one minute. Still smaller quantities, when injected into the veins, caused death with even greater rapidity. (Christison on Poisons, p. 856).

HENBANE.

Hyoscyamus. Leaves of *Hyoscyamus niger.*

Nat. Ord.—Solanaceæ. *Sex. Syst.*—Pentandria Monogynia.

Henbane grows wild in most parts of this country, but is also cultivated in the famous medicinal gardens at Mitcham, in Surrey. All parts of the plant manifest peculiar narcotic properties, but the leaves are the principal officinal part. They are of a yellowish-brown colour, rough and hairy, with a clammy appearance, a fetid, narcotic odour, and a nauseous, bitter taste. The seeds are also recognised by the London College, but are difficult to collect in quantity. They resemble the leaves in taste and odour, are of a yellowish-brown colour, rough, ovoid, and somewhat less than those of the poppy. The root is white, contains much starch, and is similar in appearance to the parsnip, for which it has occasionally been mistaken. There are two varieties of henbane, an annual and a biennial; the latter being larger, stronger, more branched, and clammy, and generally considered the more active of the two.

Henbane consists chiefly of water, woody fibre, fatty oil, resin, albumen, and an actively poisonous alkaloid termed *hyoscyamia*, which bears a close resemblance to atropia, the active principle of belladonna, and is crystalline, sparingly soluble in water, readily dissolved by alcohol, of a nauseous, acrid taste, volatile, and, like most other narcotic alkaloids, very easily decomposed by heat. When hyoscyamus is subjected to destructive distillation it yields a very poisonous volatile empyreumatic oil, which probably contains the hyoscyamia in a modified form.

Actions and Uses.—As a poison henbane is narcotico-acrid, as a medicine, anodyne, calmative, and antispasmodic. It closely resembles belladonna and other *solanaceæ* in its general actions. It has little perceptible effect on ruminants; but acts somewhat more powerfully on the horse, three to four ounces of the leaves given in decoction causing excessive dilatation of the pupils, spasmodic movements of the lips, and increased frequency of the pulse, but no symptoms of acute poisoning. It affects the dog much in the same way as it does man, causing dilatation of the pupil, insensibility to light, small depressed pulse, and coma, often disturbed by delirium. Hyoscyamus is little used by British veterinary surgeons. It seems almost useless either for horses or cattle; but may be given to dogs as a calmative and antispasmodic, and a convenient substitute for opium. When combined with drastic cathartics it effectually prevents griping, without diminishing purgation. For external purposes it is generally superseded by belladonna.

Doses, etc.—The leaves are not used in their crude state. Their most convenient medicinal preparations are—the extract, made by evaporating the expressed juice; and the tincture, prepared by percolating two pints of proof spirit through five ounces of dried powdered hyoscyamus. For the dog, the dose of the former is grs. v. to grs. x.; of the latter ♏xl. to ♏l.

HONEY.

Mel. Saccharine secretion of *Apis mellifica.*—(Ed. Phar).

Honey is extracted from flowers by the neuter bees, which carry it to the hive in a sacular distention of the œsophagus, in which it undergoes some slight changes before being poured into the honeycomb. It is a viscid, fragrant, aromatic, sweet fluid, varying in flavour with the food obtained by the bees; and slowly concretes and crystallizes when exposed to the air. It has a slightly stimulant action on the mucous surfaces, and hence in large doses operates as a laxative. It is a more expensive and less effectual demulcent and emollient than gum or starch; and is seldom prescribed by veterinarians, except occasionally in colds and aphthæ, in which it is sometimes used in the form of *oxymel,* which is made by dissolving two pounds of sugar in a pint of vinegar. On account of its liability to ferment, honey is less suitable than treacle for making up boluses or other pharmaceutical preparations.

IODINE.

Iodineum. I.

This chemical element was discovered in 1812 by M. Courtois, a saltpetre manufacturer in Paris. Its medicinal properties were investigated by Dr Coindet, senior, of Geneva, in 1820; and since that time it has come into general use, both in human and veterinary practice.

Preparation.—The iodine used in this country is prepared in Glasgow from kelp—the semi-vitrified ashes of various sorts of sea-weed—by breaking it into small pieces, dissolving it in water, and allowing the common salt, carbonate and sulphate of soda, and chloride of potassium to crystallize out. The iodine ley remains as a dense dark brown liquid, containing the iodine chiefly in combination with sodium. This liquid is treated with sulphuric acid and black oxide of manganese, and heated in leaden retorts with spherical glass condensers, into which the iodine volatilizes. The reaction which occurs may be understood by referring to the following equation, of which the first part represents the substances as they are put into the retorts, and the second as they exist after heat has been applied :—

$$\mathrm{Na\,I + Mn\,O^2 + 2\,SO^3 = Na\,O, SO^3 + Mn\,O, SO^3 + I.}$$

Properties.—Iodine usually occurs in small black, or blueish-black scales, which are soft, brittle, and easily pulverised. It has an acrid disagreeable taste, and a pungent, unpleasant odour, somewhat resembling that of chlorine or sea water. Its density is 4·94. When applied to the skin it produces a yellow stain, which, however, is readily removed by alkaline solutions. At the temperature of the atmosphere it slowly evaporates; at 212° its vapour rises with that of water; and at 350° it volatilizes entirely in beautiful violet-coloured, heavy, irritating vapours.

It forms with water a brownish-yellow solution, which contains, however, only one-thousandth part of iodine. It is entirely dissolved by twelve parts of rectified spirit, and by still smaller quantities of ether, volatile oils, and many saline solutions, of which the best and most commonly used is a solution of iodide of potassium, with which iodine forms a red-brown fluid. Iodine readily unites with bases, and forms many compounds used in medicine. Those with the alkalies closely resemble iodine in their actions, whilst those with the heavy metals partake chiefly of the properties of the base. Iodine is easily distinguished by its characteristic odour, by the brown stain which it leaves on the fingers when touched, the violet-coloured vapour which it evolves when heated, and the rose-coloured or blue compound which it forms with a cold solution of starch.

Impurities.—On account of its extensive use and high price, iodine is very apt to contain intentional adulterations as well as accidental impurities. Fixed substances, as black lead, are easily discovered by remaining as a residue when the sophisticated article is heated. Water, which is frequently present, sometimes in the proportion of fifteen or twenty per cent., may be readily discovered, for the little scales of iodine, if narrowly examined, will exhibit minute drops of moisture adhering to them; if rolled in bibulous paper they will moisten it; or if shaken in a dry phial they will adhere to its sides. The following test is of still greater delicacy, and capable of detecting two per cent. of water, or any other impurity:—

"Thirty-nine grains, with nine grains of quicklime and three ounces of water, when heated short of ebullition, slowly form a perfect solution, which is yellowish or brownish if the iodine be pure, but colourless if there be above two per cent. of water or other impurity."—(Edin. Phar).

Actions and Uses.—Iodine in large doses is irritant and corrosive; and in medicinal doses tonic, deobstruent, and capable of producing, when given for some time, a peculiar state of general disturbance termed *iodism*.

Its irritant action on the lower animals is not very energetic. When placed in the cellular tissue it causes local inflammation and the formation of abscesses. Quantities of two or three drachms of solid iodine, when given to dogs, are speedily evacuated by vomiting; but, when the œsophagus is tied, they cause death in from two to seven days, producing numerous yellow spots and little ulcers in the stomach, and a peculiar rose-tint of the liver. (Cogswell). Hertwig found that such doses killed every dog to which they were given. Horses and cattle are less susceptible than dogs, both of the local irritant, and general constitutional effects of iodine. This probably results from the structure of their alimentary canal, the chemical nature of their alimentary juices, and the large quantities of starchy food which are present in the canal, and which convert the iodine into the mild insoluble iodide of starch. Hertwig mentions that doses of from forty to sixty grains given to horses twice a day, for fourteen days continuously, caused merely slight diarrhœa, with black-coloured evacuations and increasing emaciation. Professor Dick has repeatedly given iodine to the horse in large quantities for several weeks, without observing any other symptom than the total refusal of water. In one case, he gave for three weeks doses averaging two drachms per day, and amounting, towards the end of the experiment, to two ounces daily. Quantities of several ounces have also been given to cattle with the same negative results. But the slight effects observed in these, and in Professor Dick's cases, while they certainly depend in great part on the natural unsusceptibility of horses and cattle to the poisonous action of iodine, are also partly owing to the iodine having been given in the solid form, and hence being slowly, and perhaps only partially, dissolved and absorbed. It is no uncommon thing to find boluses of iodine, and, indeed, of many other substances, in the intestines of horses, almost in the same condition in which they were administered several days or weeks before—a strong argument in favour of giving medicine in as soluble a condition as possible. But though iodine has often little effect on horses and cattle when given in these large doses, and in a solid state, still, in medicinal doses, and in a properly soluble form, it usually produces marked physiological and therapeutic effects. It imparts new activity to the digestive and assimilative processes, and improves the appetite and the general strength. Hence it is usually considered a tonic. When given for some time, it also increases the nasal mucus and saliva, as well as the biliary and pancreatic fluids, and accelerates the removal of effete matters, and the assimilation of fresh materials. During its employment, various morbid processes are arrested, and glandular enlargements absorbed, which entitles it to the appellation of a deobstruent. These effects are usually said to depend on an alterative action ; but this, though a common and popular explanation, is by no means sufficient or satisfactory. They probably do result from some beneficial changes effected by the iodine on the blood and solids nourished by it ; but such changes appear to originate in the stimulant action, which it exerts specially on the secreting glands and vessels. When given for a long time in considerable doses, it produces a state of constitutional debility, emaciation, and derangement of almost all the functions, called *iodism*. The usual symptoms of this condition are loss of appetite, abstinence from water, languor, and inaptitude for exertion. In the human subject wasting of the testicles and mammæ have been observed ; and in the bull atrophy of the testicles with loss of sexual desire. (Morton). But among the lower animals iodism is of exceedingly rare occurrence, and even in man it is now scarcely ever seen. Where it does occur it may be readily arrested by immediately withholding the medicine ; exhibiting quantities of starch so as to convert any iodine that may still be unabsorbed into the mild innocuous iodide of starch ; and then giving mineral tonics, bitters, and a nutritious diet.

Iodine produces its constitutional effects by whatever channel it enters the body. Like the other non-metallic elements, it unites with hydrogen. Being thus converted into hydriodic acid, it is absorbed, and may be detected in many of the secretions and exertions ; as in the blood, sweat, saliva, milk, and especially in the urine, by adding to them a cold solution of starch, and then a little chlorine or a few drops of nitric acid, when the blue iodide of starch is immediately formed. Iodine leaves the body chiefly in the urine. Many consider that, like mercury, lead, and digitalis, it has a cumulative effect. But this is extremely doubtful; for it has been given to man in small doses for many months together, and even for more than a year, without any deleterious consequences being observed; while its effects, unlike those of mercury and other undoubted cumulatives, cease whenever its administration is discontinued.

Its compounds with iron, copper, or mercury are generally believed to have few of the actions of iodine; and in large doses, in which their effects are most discernible, exhibit only the actions of the base. The iodide of potassium, however, retains all the more important properties of the iodine, only differing from it in being somewhat less powerful, and rather apt to act on the kidneys.

Iodine is employed in many different diseases sometimes rationally, and often empirically. In inflammatory affections it is unsuitable so long as acute inflammation and fever continue; but, when these are subdued, it is of much service in all animals as a tonic in promoting convalescence, and as a resolvent for removing effusions such as hydrothorax and ascites, indurations of mucous membranes and enlargements of glands. Indeed, in chronic glandular affections, few remedies are so effectual as iodine; and perhaps the best proof of this is its success in reducing enlargements of the thyroid gland—a disease occasionally met with in man, and known as goître, or Derbyshire neck. It is often serviceable amongst the lower animals in chronic enlargements of the liver and udder, and also in rheumatism, especially that of a chronic nature and amongst cattle. It is given with undoubted benefit to all animals in scrofulous affections, as in diseases of the mesenteric glands, phthisis pulmonalis, and malignant tumours. There are no cases in veterinary practice in which iodine is of more decided and unfailing advantage than in that variety of diabetes insipidus which affects the horse. In this disease from twenty to thirty pints of urine are often evacuated daily, the animal suffers from intense and insatiable thirst, and rapidly loses strength and flesh. The symptoms, however, even when very aggravated, yield almost immediately to the use of iodine; the thirst disappears, the urine is reduced to its normal quantity, and the animal is restored to perfect health, and that often within two or three days. The modus operandi of iodine in curing diabetes is not very evident, the removal of thirst being the only apparent physiological action capable of exerting any curative influence. Its tonic action can have little to do with this therapeutic effect, for one or two doses are often sufficient to establish a perfect cure, while no such curative result is produced by iron, quinine, or other powerful tonics. Iodine is used by some practitioners in the treatment of chorea and epilepsy in dogs; but without much advantage. It is said to mitigate the evil of excessive doses of mercury; to arrest the process of ulceration; and to counteract poisoning by strychnia, brucia, and veratria.

Iodine is much used externally. When applied to a mucous surface or to the skin, especially where it is thin and tender, it causes superficial inflammation. Hence it is used as a stimulant and resolvent in swellings of joints, bursal enlargements, strains of tendons, thickening of the periosteum, scrofulous and other tumours, and indurations of the udder, in which it is most effectual when frequently applied with smart friction. In cutaneous eruptions, as mange, scab, and ring-worm, it is often of much benefit; as also in mallenders, sallenders and other sorts of scurfiness, especially in the neighbourhood of joints. In many of these cases it may be advantageously mixed with mercurial ointment, or used alternately with it. Iodine is contra-indicated in high fever, acute inflammation, and derangement of the bowels. Hertwig considers that, in most affections of the eyes, even in those of a chronic kind, it does more harm than good.

Doses, etc.—The dose of iodine for the horse is from ℈i. to ℈iij.; for cattle, from ℈iij. to ℈iv.; and for dogs, from grs. iij. to grs. viij. Such doses should be given three or four times a day; and may be continued for a week or ten days, then withheld for a day or two, and if necessary again administered as before. Much larger doses than these are often given with impunity, but in most cases without any increased medicinal effect. If it be thought requisite to give iodine in very large quantity it should be exhibited in moderate, but often repeated, doses. When so used it is more certain in its effects, and less apt to derange the bowels than when administered in large doses. It should be given some time after eating, so as to prevent as much as possible its conversion into the mild, insoluble iodide of starch. It is usually given to horses and dogs in boluses made up with any convenient excipient; but though this form recommends itself by its facility of administration, it is more uncertain in its effects than a good fluid preparation. Such a preparation may be readily obtained by shaking one part of iodine, and one of iodide of potassium, in two or three parts of water. The addition of the iodide of potassium, whilst it does not interfere with or alter the action of the iodine, ensures its perfect solution and full action. The solution may be diluted with water as required, and its dose is easily ascertained, for the iodide is about half as powerful as iodine itself. Some practitioners use the compound solution of the Edin. Phar., which is thus prepared :—" Take of iodine two drachms; iodide of potassium an ounce; distilled water sixteen fluid ounces. Dissolve the iodide and iodine in the water with gentle heat and agitation." Each fluid ounce of this solution contains grs. xxx. of iodide of potassium, and grs. viiss. of iodine; and is equivalent to twenty-eight grs. of iodine. The dose of it for horses and oxen varies from f℥i. to f℥ij., and for dogs from fʒi. to fʒij.

Tinctures of iodine should be made, like the watery solutions, with iodide of potassium, otherwise they do not bear dilution. They are, however, little used, and for most purposes have nothing to recommend them in preference to the compound solutions, which have the advantage of cheapness.

For external use the compound solution is often quite suitable, but an ointment may also be employed. That commonly used at the Edinburgh Veterinary College contains one part of iodine and eight of lard. This, when freshly prepared and applied with smart friction, acts very well. But the iodine is apt to separate from the lard and become partly volatilized; whilst the insoluble iodine is often only partially absorbed. These evils may be easily obviated by using one part each of iodine and iodide of potassium, with six or eight of lard. For external purposes, especially for all cutaneous diseases, the *iodide of sulphur* bears favourable comparison with most remedies. It is readily prepared by "heating gently in a clean oil flask four parts of iodine with one part of sulphur until fusion is effected. Part of the iodine volatilizes, and the remainder unites with the sulphur." (Pereira). It is a red-brown fluid, and is generally used as an ointment made up with six or eight parts of lard.

IPECACUAN.

Ipecacuanha. Root of *Cephaëlis Ipecacuanha.*

Nat. Ord.—Rubiaceæ. *Sex. Syst.*—Pentandria Monogynia.

The *Cephaëlis Ipecacuanha* is a small Brazilian plant with a creeping stem, which gives off a few branches ascending to the height of several inches. The root, which is the officinal part, is collected at all seasons. It occurs in twisted, knotted, annulated pieces, a few inches in length, of the thickness of a quill, and covered with a brown bark, which is of greater medicinal value than the white internal woody matter. Though brittle, it is hard, and difficult to pulverise. The powder is greyish yellow, and has an acrid taste, and a faint nauseous odour. It communicates its properties to water and alcohol. The cortical, external, and most active part of the root contains a fixed fatty matter, wax, gum, starch, lignine, about two per cent. of an odorous volatile oil, and about one per cent. of a colourless, uncrystallizable alkaloid called *emetina.* It is of such activity that two grains given to a dog caused violent vomiting, inflammation of the stomach and intestines, stupor, and death in twenty-four hours. (Magendie).

Actions and Uses.—Ipecacuan is irritant, emetic, slightly cathartic; and in the human subject diaphoretic and expectorant. In virtue of its emetic action it is also sedative. It has little observable effect on either horses or cattle; but causes considerable irritation of the alimentary canal in dogs and other carnivora. In canine patients it is, in properly regulated doses, a mild and safe emetic. It does not, however, act so rapidly as sulphates of zinc or of copper, and does not produce so much secondary nausea and depression as tartarised antimony. When it fails in producing a full emetic effect, it usually acts as a laxative. When given to the human subject it also augments the secretion of the skin and pulmonary mucous membrane, and these effects may be developed independently of any other action, by giving the medicine in combination with opium, and in doses insufficient to cause vomiting. These diaphoretic and expectorant actions are, however, less easily produced either in dogs or in any other of the domesticated animals.

It is given to dogs and cats for the various purposes of an emetic, as to relieve derangements of the digestive organs by the evacuation of undigested food or irritant matters; and to arrest febrile and inflammatory complaints, especially of the eyes, brain, or air passages, by reducing the action of the heart, and bringing the stomach and bowels into a healthy condition.

Doses, etc.—The dose for the dog is from grs. xv. to grs. xxx.; and for the cat, grs. v. to grs. xij., given in tepid water, either alone or with a grain or two of tartar emetic. Some practitioners use as a nauseant and sudorific the celebrated *Dover's Powder,* or the pharmaceutical imitation of it, which is made by triturating together one part each of ipecacuan and opium, and eight parts of sulphate of potash. This is given to dogs in doses of grs. x. to grs. xv., and even occasionally to the horse in quantities of ʒi. or ʒij. It should be administered four or five times a day, and the patient should have plenty of diluents, and be kept well clothed.

IRON AND ITS MEDICINAL COMPOUNDS.

Iron. Ferrum. Fe.

Iron is a brilliant, lustrous metal, with a specific gravity of about 7·73. It is very tenacious, malleable, and ductile, and capable of being welded at a low red heat. The carbonate, bisulphuret, and black and red oxides, are its most common ores. It has been used in medicine for upwards of three thousand years, and appears to have been the first mineral substance administered for the cure of disease. It is still sometimes given in the metallic state, in the form either of wire or filings, as an antidote in cases of poisoning by soluble salts of mercury and copper. Iron, so long as it remains in the metallic state, acts only mechanically. Some of its more soluble salts are irritant and caustic when given in large doses. Such are the sulphuret, nitrate, and sesqui-chloride. In properly regulated doses, all of them are astringent and tonic. The salts of the black oxide are generally more active than the corresponding salts of the red oxide. The Pharmacopœias include upwards of twenty compounds of iron; but the number is unnecessarily great, for all owe their properties to a common base, and differ but little even in the degree of their action. I shall only notice the sesqui-oxide, carbonate, sulphate, and iodide; and even this small number might possibly be diminished without materially weakening our curative resources.

Red or Sesqui-oxide of Iron. Ferrugo. Rust of Iron. $Fe^2 O^3$.

The red oxide of iron is found native in the different varieties of hæmatite, ochre, and red chalk. For medicinal purposes it is prepared in the form of a hydrate, by boiling a solution of green vitriol with a few drops of nitric acid, and as much sulphuric acid as it already contains; decomposing the solution of sesqui-sulphate ($Fe^2 O^3$, $3 SO^3$) so made, by ammonia or carbonate of potash or soda; and washing the soft red-brown magma thrown down. This is a hydrated sesqui-oxide, with the composition $Fe^2O^3 + 2 HO$. When dried, it constitutes the red-brown sesqui-oxide of the shops. It is devoid of odour, and insoluble in water. When heated, it assumes a purple colour, and loses its chalybeate taste. It dissolves in hydrochloric acid without effervescence.

Actions and Uses.—The red oxide closely resembles the other compounds of iron in its general actions; but is considerably less active. It is seldom used internally, and is only of medicinal importance as being the best antidote for arsenical poisoning. It is generally believed to owe its efficacy to its causing the formation of an insoluble arsenite of the protoxide of iron; and is most effectual when given in the form of the soft red-brown magma above noticed. Dr Douglas Maclagan says that 12, and Devergie that 32, parts of this are sufficient to neutralise one part of arsenious acid.

CARBONATE OF IRON. Ferri Carbonas. $Fe\ O, CO^2$.

Carbonate of the protoxide of iron is the compound present in the clay-iron ore, and in many mineral waters. It may be readily prepared by decomposing a solution of sulphate of iron or green vitriol by carbonate of soda. It is a greyish-green body, having a chalybeate inky taste, and dissolving with brisk effervescence in muriatic acid. Water, unless containing a considerable proportion of carbonic acid, fails to dissolve it. When exposed to the air, it very readily gives off its carbonic acid, and becomes converted into the red hydrated sesqui-oxide—a change constantly taking place along the banks of chalybeate waters. To prevent this decomposition, Dr Clark of Aberdeen proposed to boil the freshly made carbonate with sugar; and this plan is now adopted by the Edinburgh Pharmacopœia in the preparation of the *saccharine carbonate of iron*—the only form in which the salt can be preserved for use. The directions of the College are as follows:—

"Take of sulphate of iron, four ounces; carbonate of soda, five ounces; pure sugar, two ounces; water, four pints; dissolve the sulphate and carbonate each in two pints of the water; add the solutions, and mix them; collect the precipitate on a cloth filter, and immediately wash it with cold water; squeeze out as much of the water as possible, and without delay triturate the pulp which remains with the sugar previously in fine powder. Dry the mixture at a temperature not much above 120°."—(Ed. Phar.)

The saccharine carbonate of iron, when thus prepared, has a dirty bluish-green colour, and a sweet inky taste. It consists of carbonate of iron, with about 20 per cent. of sesqui-oxide. (Christison).

Actions and Uses.—The saccharine carbonate, from its solubility in acidulous solutions, and perhaps from other causes, is an active and valuable chalybeate; and, as such, it is used for all the purposes to which the sulphate is more commonly applied. It is administered in the same doses as the sulphate.

SULPHATE OF IRON. Ferri Sulphas. Green Vitriol. Copperas. $FeO, SO^3 + 7\ HO$.

All the sulphate of iron used in commerce and medicine is prepared by the manufacturing chemist from a clayey shale or alum schist, highly impregnated with pyrites or bisulphuret of iron ($Fe\ S^2$). Such schists yield both alum and sulphate of iron by the same process. They are broken into fragments, which are placed in large heaps, frequently wetted, and exposed to the air for several months. The aluminum, the iron, and the sulphur of the shale thus treated, absorb oxygen, and hence are produced alumina, oxide of iron, and sulphuric acid, the last of which speedily unites with the two bases, forming sulphate of alumina and sulphate of iron. Large quantities of water are then added, and the solution thus obtained is evaporated, when the sulphate of iron crystallises out, leaving the more soluble sulphate of alumina in solution.

Properties.—Sulphate of iron occurs in bluish-green, oblique rhombic prisms, which, on exposure to the air, gradually absorb oxygen, becoming opaque, and covered with a red coating of sesqui-oxide. In specimens containing an excess of sulphuric acid, the oxidation ensues less rapidly. It has an intensely inky metallic taste; and is soluble in three-fourths of its weight of boiling water, and twice its weight of cold water. When heated it fuses, and readily parts with six atoms of its water of crystallization, retaining, however, the seventh far more tenaciously. The characters already mentioned are sufficient to distinguish it in mass. In solution, it is easily identified by its giving, with hydro-sulphuret of ammonia, a black precipitate of sulphuret of iron ($Fe\ S$); with caustic potash, a green precipitate of oxide

(Fe O); with yellow prussiate of potash, a whitish-blue precipitate, which gradually deepens in colour; and with a solution of galls, a black precipitate, which forms the basis of common ink. These tests will also identify any other proto-salt as well as the sulphate.

Actions and Uses.—Sulphate of iron is irritant, astringent, and tonic.

Its irritant properties appear to depend on its chemical action on the albuminous tissues, and the vital reaction consequently induced. It is, however, so slight as to be scarcely observable either in horses or cattle. In dogs, Dr Smith found that two drachms introduced into the stomach occasioned vomiting and death in about twenty-four hours; as also "redness of the alimentary mucous membrane, and the effusion of a thick layer of tough mucus;" and that the same quantity applied to a wound, proved fatal in twelve hours.[1] The astringent action of the salt appears to be merely a mild degree of its irritant action; is exerted both locally and on the system at large; and probably induces that diminution in the size, and increase in the firmness, of the spleen, mentioned by Weinhold as the common effect of the continued exhibition of sulphate of iron to dogs.[2] When given in small and repeated doses, it acts not only as an astringent, but also as a tonic, increasing the amount of the red globules, and, according to the chemical school of therapeutics, directly supplying iron to the hæmatosin. But this explanation is unsatisfactory; for salts of copper, zinc, and silver, besides quinine, cod-liver oil, and substances of very dissimilar composition, and which can supply no iron to faulty hæmatosin, appear to produce tonic effects similar, if not identical, with those of iron. Such effects more probably depend on a chemically astringent, and vitally invigorating influence, exerted first on the intestinal canal, and subsequently on all parts of the body to which the medicine is carried in the blood. But the tonic action of iron, however obscure in its *modus operandi*, is certain and power-

[1] Christison on Poisons, p. 506.
[2] Pereira's Elements of Mat. Med., pp. 193 and 776.

ful, and consequently of much service in the alleviation and cure of many diseases affecting the domesticated animals.

Sulphate of iron is beneficially administered in all cases where the powers of life are languishing and depressed; in diabetes and internal hemorrhages; dysentery, consumption, and various other forms of scrofula; in sub-acute and exhausting affections of the mucous membranes and skin, as scarlatina, erysipelas, and purpura hæmorrhagica; in indigestion and impaired action of the bowels, depending upon local atony and general weakness; in chorea and occasionally also in epilepsy; and in convalescence from most acute debilitating diseases. In the treatment of such cases, the patient must further be provided with a clean, roomy, well-ventilated dwelling, and abundance of good, easily digested, and nutritive food. When such sanitary conditions are neglected, tonics, and indeed all medicines, act slowly and imperfectly. Sulphate of iron, although scarcely entitled to be considered an anthelmintic, may often prevent the production of worms, by arresting an undue accumulation of mucus, and imparting a healthy tone to the intestines. Although itself devoid of cathartic action, it increases the activity of most purgatives with which it is combined. It is occasionally used externally as a styptic and astringent, usually in the form of powder or solution. Sulphate of iron is contra-indicated where there is excessive firmness of the muscular system; where the bloodvessels are unduly filled with blood containing an abnormal proportion of red globules; and where there is acute fever, active inflammation, or much irritability of the bowels. During early convalescence from inflammatory complaints milder tonics are often preferable.

Doses, etc.—The dose for the horse is from ʒi. to ʒiij.; for cattle, from ʒij. to ʒiv.; and for dogs, from grs. xv. to grs. xxv. These doses should be repeated three or four times a day; and may either be made into a bolus with linseed meal, dissolved in water, or mixed with soft food. After being used for several days, sulphate of iron should either be withheld altogether for a day or two, or replaced during that time by some other tonic. This, besides preventing derangement of the digestive organs, also appears to maintain the continued efficacy of the medicine. Care should further be taken that, during its use, the bowels be kept open, by the occasional exhibition of laxatives, which are especially necessary in horses and dogs on account of their liability to suffer from the astringent and constipating action of the salt. The dark colour and disagreeable odour which the feces usually acquire during a chalybeate course, depend on the production, in the intestines, of the hydrated sulphuret of iron, and generally indicate that the medicine is being given in unnecessarily large doses.

Iodide of Iron. Ferri Iodidum. Fe I.

To prepare iodide of iron, 200 grains of dry iodine and 100 grains of recently cleaned fine iron wire are agitated, with six fluid ounces of distilled water, in a common soda-water bottle. The iodine and iron combine, with evolution of much heat, forming a pale green solution. The subsequent steps in the process consist in "evaporating the solution to a state of considerable concentration in contact with iron, filtering the product while hot, instantly enclosing it in a confined space, with quicklime around the basin, and heating the whole apparatus in a hot air-press, or other convenient method, till a dry salt be obtained by means of the lime absorbing the water as it undergoes evaporation." (Christison's Dispensatory).

Properties.—When thus prepared it is a greyish-black, lustrous, crystalline mass; has a styptic, metallic taste; dissolves readily in water and alcohol; gives off violet-coloured fumes of iodine when heated; and when exposed to the air deliquesces, gradually becoming of a red-brown colour. This change is owing to the formation of sesqui-oxide of iron; and is retarded by boiling the solution, from which the salt is crystallized, in syrup, or by keeping the solution secluded from light, and in well-stoppered bottles containing portions of fresh iron wire.

Actions and Uses.—The iodide of iron resembles the sulphate in its actions and uses; but is somewhat more active. It is irritant, astringent, and tonic. Though at one time it was thought to conjoin the actions of its two constituents, it is now satisfactorily shown that it resembles compounds of iron far more than those of iodine. This is especially observable when the salt is given in doses sufficiently large to induce obvious physiological effects. Thus three drachms given to a dog caused purging and vomiting; and one drachm in concentrated solution killed a rabbit in three hours and a half, with the symptoms and post-mortem appearances of poisoning with other soluble salts of iron.[1] It may be used in the same doses for exactly the same purposes as the commoner and cheaper sulphate. Mr Morton makes special mention of its efficacy in diabetes, and in nasal gleet accompanied by debility.

JALAP.

Jalapa. Root of *Exogonium Purga*.—(Bentham).

Nat. Ord.—Convolvulaceæ. *Sex. Syst.*—Pentandria Monogynia.

Jalap derives its name from Xalapa, a town in Mexico, whence it was first obtained, and from the neighbourhood of which it is to this day exported. The plant is a hardy climber, found on the heights of the American Andes, 6000 feet above the level of the sea. When brought to this country it thrives well, flowers, and comes to maturity in the open air. It has a smooth, round, brown annual stem; long-stalked cordate, and somewhat hastate leaves; purple-red flowers; and a fleshy perennial root-stock, with numerous pear-shaped tubers, varying in size from a walnut to an orange. These tubers, which are the officinal part of the plant, are gathered about March or April, just before the young shoots spring, and dried by suspending them in nets over or near the fire. The tubers of the jalap, when imported entire, are round or pear-shaped, dark-brown in colour, and more or less corrugated on the surface. Sections or slices

[1] Experimental Essay on Iodine and its Compounds. By Charles Cogswell, M.D. Harveian Prize Essay for 1837, pp. 126-134.

of the tubers are often met with; are of a hard and compact structure, a marbled appearance, and more or less marked with concentric rings and pieces of shining resin. Jalap is triturated with difficulty, unless mixed with some hard salt, as the tartrate or sulphate of potash. When powdered it has a pale brown colour, a faint disagreeable odour, and a taste at first sweet, but afterwards acrid and nauseous. It is only partially soluble in water, which separates the starchy and mucilaginous matters without the cathartic resinous principle, which, however, is readily dissolved by alcohol.

The various analysis of jalap differ considerably from each other; but the following one by Guibour, of "officinal jalap," shows its general composition :—

Resin, ...	17·65
Liquid sugar obtained by alcohol, . .	19·00
Brown saccharine extract obtained by water,	9·05
Gum and starch, ...	28·90
Woody fibre, ...	21·60
Loss, ...	3·80

The resin is the active principle of jalap; is contained in different specimens in the proportion of ten to eighteen per cent.; and is best obtained by moistening the powder with rectified spirit, and then passing it slowly through a percolator, recovering the alcohol by distillation, and evaporating the residuum to a proper consistence in a vapour bath. It has a yellow colour and an acrid taste; is insoluble in water, but soluble in alcohol; and causes, in doses of a few grains, repeated and violent purging. This resin has recently been found to consist of two different sorts,—one soft, brown, greasy, and soluble in ether; the other, the more abundant of the two, is colourless, odourless, tasteless, insoluble in ether, and remarkable for the production of a beautiful crimson colour when moistened with sulphuric acid. (Gregory).

Jalap is not very liable to adulteration. When of good quality it is dark-coloured, dry, compact in structure, and with an acrid, bitter taste. Worm-eaten roots are more active than those which are sound, for, the starch being removed, the resinous substance remains in relatively larger amount.

Actions and Uses.—Jalap is irritant and cathartic. Two drachms caused the death of a small dog, when the œsophagus was tied so as to prevent the drug being vomited. When a large quantity is rubbed into the skin, or applied to any of the mucous membranes, it excites inflammation. As a cathartic, it has little effect either on horses or cattle. Two or three ounces given to the horse have no effect on the bowels, but act slightly on the kidneys (Moiroud); and the same and even larger quantities are without perceptible effect on cattle. Even in dogs its cathartic action is mild. It is believed to operate chiefly on the small intestines, increasing both their secretions and their peristaltic motion. It is used for all the ordinary purposes of a purgative for the dog; and though not very speedy, is safe and certain in its effects. It is also useful as a vermifuge.

Doses, etc.—The dose is from ʒi. to ʒij.; but it is better to give it in combination than alone. One of the best purges that can be used for dogs consists of from ℈i. to ʒi. of jalap, with grs. ij. or grs. iij. of calomel, made into a bolus with linseed-meal and water, or any convenient excipient.

JUNIPER TOPS AND BERRIES.

Juniperi Cacumina et Fructus. Tops and fruit of the *Juniperus communis.*

Nat. Ord.—Coniferæ. *Sex. Syst.*—Diœcia Monadelphia.

The *Juniperus communis* is a shrubby evergreen tree, growing in most temperate countries. The leaves are dark green, linear, and arranged three in a whorl. The berries are dark purple, of the same size and appearance as currants, and marked with little furrows. They have an aromatic terebinthinate odour, and a warm sweetish taste, followed by bitterness. They are chiefly brought from the shores of the Mediterranean and the Baltic. All parts of the tree have very similar properties; and yield, when distilled with water, a transparent, colourless oil, possessing, in a concentrated form, all the characteristics of the plant. It is present in the berries in the proportion of about one per cent., and is associated with grape-sugar, gum, resin, lignine, salts of lime, and water.

Actions and Uses.—Juniper tops and berries are carminative and diuretic. In horses and cattle two ounces of the berries act only on the digestive organs; but three or four ounces induce diuresis, and also slight diaphoresis. The heart's action, however, is not affected. Juniper resembles the balsams and turpentines in its general actions; but is less stimulant. It is given as a stomachic and carminative in indigestion and flatulence; is said to diminish the evil effects of bad fodder and marshy pastures; and is believed to be serviceable both in the prevention and cure of sheep-rot. It is occasionally used as a diuretic, and is both prompt and powerful in its effects. It was at one time much used for fumigating stables and cow-houses; and its vapour was considered to be a certain cure for the filaria occasionally found in the bronchial tubes of calves and lambs. But for both these purposes it has been superseded by more effectual remedies.

Doses, etc.—As a stomachic, the dose of the berries for horses and cattle is from ℥i. to ℥iij.; for sheep, from ʒij. to ʒiv.; and for dogs, from ℈i. to ℈iij. These doses may be repeated several times a day. As a diuretic, the oil, which is the best form of administration, is given to horses and cattle in doses of fʒss.; and to the dog in doses of ♏iv.; and repeated at short intervals till diuresis is induced. The berries are usually given coarsely powdered and mixed with fodder, and are readily eaten by most animals. Sheep especially soon become very fond of them. A decoction is sometimes used both internally, and as an external stimulant.

A brown empyreumatic oil, called *huile de cade*, is got from the wood of the *Juniperus oxycedrus* by dry distillation; is used in France and other continental countries for most of the purposes of oil of tar; and is especially recommended in cutaneous diseases.

LEAD AND ITS MEDICINAL COMPOUNDS.

LEAD. Plumbum. Pb.

Lead rarely occurs native in the metallic state, but is commonly found as a carbonate or sulphuret. It has a bluish-grey colour, and is readily cut or scratched. It has a density of 11·38. When exposed to the air it oxidises, loses its metallic lustre, and becomes dull and opaque. In pure soft water it undergoes similar changes, and the oxide first formed becomes converted into the carbonate. It unites with oxygen in four several proportions, and also forms many important crystallizable salts.

Actions, etc.—Lead, in the metallic state, appears to be devoid of medicinal or poisonous action. Four ounces were given to a dog at the veterinary school of Lyons, without effect. The metal may sometimes, however, be converted within the body into an oxide or active salt. The soluble compounds of lead, as the nitrate and acetates, are corrosive and irritant. Those which are insoluble, as the oxides and carbonates, have scarcely any irritant action. All preparations of lead, when introduced into the system in repeated doses, for some time continuously, induce a peculiar state called *plumbism*, which is sometimes met with among the lower animals, though not so often as in man. In the end of 1851, Mr Shenton, an intelligent veterinary surgeon, practising in Derbyshire, had eleven fatal cases of this disease among horses, and several among cattle; and about the same time, Mr Mayor, V.S., of Penrith, had two horses that died near the head of Ullswater, in Westmoreland.[1] The symptoms of lead poisoning among the lower animals appear very analogous to those observed in man. They usually continue, in a more or less aggravated form, for several weeks or months. They appear to depend on the accumulation of lead in the system, and the consequent impairment of the digestive functions and deterioration

[1] See Dr George Wilson's excellent paper on cases of lead poisoning in the Monthly Journal of Medical Science for May 1852.

of the blood. The appetite becomes capricious, sometimes entirely gone, and at other times morbidly increased. Frequent and severe attacks of colic come on, and the bowels are usually torpid from a paralysed condition of the muscular coat of the intestines; but this condition is not so invariable as in the human subject. The gums and teeth are of a grey or blue colour. The animals suffer a good deal of pain, gradually fall off in strength and condition, and exhibit a disordered or depressed state of the nervous system, with symptoms of paralysis, epilepsy, or apoplexy. Indeed, these diseases occasionally simulate some forms of lead poisoning so exactly, as to have been mistaken for them by various practitioners. In a letter which I received from Mr Shenton, in April 1852, he thus describes the symptoms in those cases of lead poisoning which came under his observation. "There was a rough staring coat, a tucked-up appearance of the abdomen, and a slightly accelerated pulse; in fact, symptoms of febrile excitement, which usually, however, passed away in about a week. About this time, large quantities of grey-coloured matter were discharged from the nostrils, and saliva from the mouth; but at no time was there any enlargement of the submaxillary, lymphatic, or salivary glands. Neither was there constipation of the bowels, which appears to be nearly always present in cases of lead poisoning in man. Fits and partial paralysis came on at intervals; and when the animals got down they often struggled, for a long time ineffectually, to get up again. The breathing, up till this period, was pretty tranquil, but now became so difficult and laboured, that the patients appeared in danger of suffocation. The pulse was, in no case, above sixty or seventy, and I ascribed the difficulty of respiration to a paralysed state of the respiratory apparatus. The animals did not live more than two or three days after these symptoms appeared. The post-mortem appearances varied but little. The lungs and trachea were inflamed;—the lungs engorged with large quantities of black blood; the trachea and bronchi filled with frothy spume. In all cases but two, the villous part of the stomach presented isolated patches of increased vascular action; and in all cases the intestines, and especially the large ones, were inflamed. The blind pouch of the cæcum was nearly gangrenous. There was nothing remarkable about the liver, spleen, or kidneys, except that they were of a singularly blue appearance. The brain and spinal cord were not examined." It may further be observed, that, in dogs destroyed in about three weeks by lead poisoning, the muscular system was flaccid, pale, and bloodless. (Schwepfer).

When animals are killed while labouring under the saturnine malady, or die from its effects, lead can usually be found in most parts of the body. It has been detected in the blood, the contents of the stomach and intestines, the brain and spinal cord, the muscles, lungs, liver, and spleen. It has hitherto been generally believed that lead accumulates particularly in the liver; but this appears doubtful, for Dr George Wilson has recently discovered it in especially large amount in the spleen,—an organ which can always be speedily and easily examined, on account of "its small size, loose, spongy texture, and comparative freedom from fatty matter." The best process for preparing for analysis the different organs and parts to be examined, in cases of lead-poisoning, is that which Dr Wilson followed in the chemical investigation of Messrs Shenton and Mayor's cases above referred to. The organs should be digested in aqua regia, over a slow fire, until all the soluble matters are separated The liquid, which should then be clear and pale brown, is cooled, filtered through calico, and evaporated. The dried residue is charred in a Hessian crucible, boiled with diluted nitric acid, filtered, dried, and dissolved in dilute hydrochloric acid. This solution will usually be sufficiently pure to exhibit with appropriate reagents the characteristic reactions of lead and its compounds. It should give a black precipitate, with sulphuretted hydrogen and hydro-sulphuret of ammonia; a white precipitate, with sulphuric acid and soluble sulphates; and bright gamboge yellow crystalline precipitates, with iodide of potassium and chromate of potash.

In cases of lead poisoning among the lower animals, the metal usually enters the body in the food or water which the animal consumes. Lead poisoning sometimes occurs from drinking water conveyed through leaden pipes, or allowed to stand in leaden cisterns. The conjoined action of the air and moisture soon produces, on the surface of the metal, a crust of hydrated oxide, which unites with carbonic acid drawn from the air, and crumbles away as a crystalline powder, partly dissolved and partly suspended in the fluid. According to Professor Christison, this crust consists of two equivalents of neutral carbonate and one of hydrated oxide. Leaden vessels, or vessels with lead solder, must therefore be used with caution for holding, especially for any length of time, waters or other fluids likely to effect a solvent action on the metal. This caution is especially applicable to the softest and purest waters, as distilled rain, or snow waters. Hard waters, however, are not liable to be contaminated with lead, for their carbonates, sulphates, phosphates, or other salts, are decomposed; and the carbonic, sulphuric, phosphoric, or other acid, unites with the lead, forming slowly an insoluble crust, which effectually protects the metal from any further action of the air or water. In virtue of the conservative power of these saline matters, most spring and river waters can without risk of harm be conveyed in leaden pipes, or kept for a moderate time in leaden cisterns; while, in imitation of this natural change, leaden pipes or cisterns may be rendered perfectly safe for containing even the softest water by keeping them for a few days filled with solutions of phosphate, sulphate, or carbonate of soda, or even nitrate of potash or common salt. An insoluble and impervious covering is thus produced, effectually preserving the metal from corrosion, and the water from saturnine impregnation.

There are two chemical antidotes for poisoning with lead, namely, sulphuretted hydrogen, which converts it into the insoluble black sulphuret; and sulphuric acid, which converts it into the insoluble white sulphate. These antidotes should be given with diluents. In treating cases of lead poisoning, the bowels must be opened by saline purgatives, and sulphate of magnesia appears especially suitable. Where there is much pain opium must be prescribed; and in all cases good feeding and tonics are necessary to perfect a cure. It need scarcely be added that all food and water impregnated with the poison must be carefully avoided.

OXIDE OF LEAD. Litharge. Plumbi Oxidum. Pb O.

When melted lead is exposed to a current of air it oxidises, forming a yellow semi-crystalline powder called *massicot;* and when this is fused at a red heat it acquires a foliaceous or scaly structure, and a red or greyish-red colour, and is known as *litharge.* It is insoluble in water and spirit, but combines with acids, forming salts which are colourless unless coloured by the acid. It may be readily identified as a preparation of lead by the tests above-mentioned. One of the simplest tests for its purity is its being almost entirely soluble in diluted nitric acid.

Actions and Uses.—Litharge, in large doses, acts as an irritant; and also produces the usual constitutional effects of other lead compounds. It is not administered internally, but is occasionally used externally as an astringent and desicant. Many vegetable fluids when shaken with it are deprived of their colour; and it is sometimes used for this purpose by pharmaceutical chemists. It is largely employed in the preparation of the *emplastrum lithargyri*—the diachylon plaster or common sticking plaster. The Edinburgh College gives the following directions for its preparation:—"Take of litharge in very fine powder, five ounces; olive oil, twelve fluid ounces; water, three fluid ounces; mix them, boil and stir constantly till the oil and litharge unite, replacing the water if it evaporate too far." When these ingredients are thus heated together (at a temperature between 200° and 212°), the oil undergoes a change similar to what occurs in the making of soap. It separates into two parts,—a sweet, soluble, basic principle called glycerine; and several fatty acids, of which the chief are the oleic and margaric. These fatty acids unite with the oxide of lead, and the substance so formed may thus be regarded as a soap in which oxide of lead has taken the place of potash or soda. The lead plaster is sold in rolls, about a foot in length, of a yellowish-white colour, and a faint, sweet, soapy odour. It is brittle when cold, but becomes soft and adhesive when heated. It is a mild stimulant, and a useful agent for uniting incised wounds, and protecting them from the action of the air. It is generally used spread on linen or calico. Such plasters may be rendered more adhesive, and consequently better adapted for most veterinary purposes, by adding three or four ounces of resin to every pound of the lead plaster.

IODIDE OF LEAD. Plumbi iodidum. Pb I.

Iodide of lead is best prepared with equal parts of nitrate of lead and iodide of potassium. Each salt is dissolved in a small quantity of water, and the solutions mixed, when double decomposition occurs, nitrate of potash remaining in solution, and iodide of lead precipitating. It is met with in brilliant golden-yellow crystalline scales; or in a fine, bright yellow, heavy powder. It is tasteless, colourless, and very sparingly soluble in water.

Actions and Uses.—In its physiological actions it resembles the other salts of lead; but exhibits no effects which indicate its acting as a compound of iodine. In the belief, however, of its uniting the actions of lead and iodine, it has been prescribed for the reduction of scrofulous and other indolent tumours, being commonly used internally, and also at the same time externally, in the form of an ointment. But as its efficacy in these cases is not well established, and as the effects ascribed to it are more certainly produced by other remedies, there is little use of retaining it in the veterinary materia medica.

ACETATE OF LEAD. Sugar of lead. Plumbi acetas. Pb O, $\bar{A}$ + 3HO.

DIACETATE OF LEAD. Plumbi diacetas. 2Pb O, $\bar{A}$.

There are at least five different acetates of lead, but only two of them are of much medicinal value, namely, the neutral acetate, or sugar of lead, and the diacetate which forms the solution generally sold in the shops as Goulard's Extract.

Preparation and Properties.—Sugar of lead is obtained by dissolving litharge in acetic acid; or very commonly on the large scale, by immersing sheets of lead in diluted pyroligneous acid, scraping off the crust of subacetate and subcarbonate which accumulates, dissolving it in acetic acid, and evaporating the solution. Acetate of lead is sold in minute needle-like crystals, having an acetous odour, and a sweet astringent taste. Water at 60° dissolves somewhat less than its own weight of it. The salt, when dissolved, has a remarkable power of uniting with different proportions of the oxide, forming subsalts; and one of these, namely, the diacetate, is the chief ingredient of the familiar Goulard's Extract, which usually, however, also contains several other subacetates. The officinal *solution of the diacetate* is thus prepared :—

"Take of acetate of lead, six ounces and six drachms; litharge, in fine powder, four ounces; water, a pint and a half. Boil the salt and litharge with the water for half an hour, stirring occasionally. When the solution is cold, add water, if necessary, to make up a pint and a half, and then filter. Preserve the solution in well closed bottles."—(Ed. Phar.)

It is a colourless, transparent fluid, with a sweet astringent taste; and, when evaporated, exhibits the diacetate, usually in the form of a tough, opaque, uncrystalline mass. It is distinguishable from the acetate by its yielding a copious white precipitate when a stream of carbonic acid is passed through its watery solution.

Actions and Uses.—The acetates, like the other soluble salts of lead, cause, in excessive doses, irritation, peculiar derangement of the nervous system, and depression of the action of the heart; in frequently repeated doses, those peculiar symptoms already mentioned as characterising lead poisoning; and in medicinal doses, astringent and sedative effects. The two acetates above mentioned are very similar in their actions and uses; but the diacetate, on account of its greater solubility, is probably the more active of the two, and though not used internally, is generally preferable as an external application, on account of its being less apt to dry up or crystallize.

Hertwig exhibited sugar of lead to horses in doses of a pound, and observed nausea, colic, a quick, small, hard pulse, stiffness of the limbs, paralysis of the nerves of sight, and sometimes of other parts, insensibility, and often death. Its effects on cattle are even more energetic. Prinz observed that doses of half an ounce daily, continued for three days, produced in cows feverishness, with a quick, throbbing pulse, colic, and other symptoms of abdominal pain, in one case mania, but in none death. Mecke found that quantities of eight ounces, dissolved in water, and given within two days, destroyed nine cattle; the first on the second, and the last on the fourteenth day after the poison had been given. Doses of half an ounce, administered to dogs, and retained in the stomach by tying a ligature round the œsophagus, produced intense intestinal irritation, and death occasionally in nine hours, but sometimes only after two or three days. (Orfila). On post-mortem examination, the villous coat is found grey and of a macerated appearance, owing to the chemical action of the salt, and sometimes vascular, especially in cases that survive long. Similar symptoms and appearances are also observed when sugar of lead is applied in large quantity to a wound, injected into the veins, or brought into contact with any absorbing surface.

Acetate of lead owes its astringent effect in great part to its forming insoluble compounds with the albumen of the animal fluids and soft solids. Its astringent action is accompanied or succeeded by a topical sedative effect, resulting from the diminished calibre of the vessels, and probably also from some action on the nerves of the part. It is administered in cases of internal hemorrhage, and also in diarrhœa and dysentery, in which it is effectual in drying up the excessive secretions, and quieting the undue vermicular motions. In such cases, it is generally prescribed with opium. Some practitioners speak favourably of its use in diabetes. On account of its twofold action as an astringent and sedative, it is very effectual in the treatment of such cases of superficial inflammation as conjunctival ophthalmia, painful skin eruptions, and bruises. It is, besides, a useful astringent for many chronic sores. Both the acetate and diacetate have been used as deodorisers and disinfectants; but are probably much inferior to compounds of chlorine and sulphurous acid.

Doses, etc.—The dose of acetate of lead for horses and cattle is from ℈i. to ℈iij.; and for dogs, from grs. ij. to grs. v. These doses may be given either in bolus or solution, and repeated two or three times a day. Care must, however, be taken to avoid producing the constitutional effects of the poison, and the medicine must be withdrawn whenever the appetite becomes impaired, the gums discoloured, or the bowels constipated or affected by spasms. For external application, sugar of lead is used in powder, as an ointment, or more commonly dissolved in forty or fifty parts of water, with a little vinegar to increase its solubility. Goulard's extract, diluted to suit convenience, is also much used for external purposes. Whichever solution be preferred, it should, when used for the relief of inflammation, be applied diligently and for a considerable time, cloths wetted with it being kept continually about the part. A mixture of one part of Goulard's extract, and four of olive-oil, has been recommended as a cooling application for blistered or contused surfaces. (Morton).

LINSEED AND LINSEED OIL.

LINI SEMINA. Seeds of *Linum usitatissimum.*
LINI OLEUM. Expressed oil of the seeds of *Linum usitatissimum.*
SURGEON'S LINT. Tow. Lini filamenta. Fibres of *Linum usitatissimum.*

Nat. Ord.—Linaceæ. *Sex. Syst.*—Pentandria Pentagynia.

The *Linum usitatissimum* or common flax yields several important articles of the materia medica. The stem affords lint and tow; and the crushed seed linseed meal and linseed oil.

To prepare the stem for use the plant is steeped in water, which in the more recent and improved methods of procedure is used hot; the hard woody external part of the stem is removed by scutching; the interior fibrous part is hackled and carded, the coarser portions forming tow, the finer when bleached constituting surgeon's lint. Both lint and tow are often useful for protecting wounds from the irritating action of the external air; and when saturated with moisture are frequently with advantage substituted for poultices.

Flax seeds are small, smooth, and shining, of a brown colour, and oval shape, flattened laterally, and pointed at one extremity. They are inodorous, but have an oily mucilaginous taste. The external envelope of the seed consists chiefly of starch and wax, with about one-sixth of its weight of mucus. The internal nucleus contains albumen and gum, with about one-fifth part of a fatty oil—the linseed oil of commerce. The ground seed is much used as an article of diet for all the domesticated animals, especially in scrofulous affections; and is also prescribed, usually in the state of decoction, as a mild mucilaginous demulcent in irritating diesases of the intestines, kidneys, and bladder, and in poisoning with irritants and corrosives. It makes very good poultices, especially when mixed with an equal quantity of bran or oatmeal; but the bruised *oil cake*—the residue remaining after the expression of the linseed oil—is usually substituted for this purpose, as it is cheaper, less apt to become rancid, and equally effectual in retaining heat and moisture. Both linseed meal and bruised oil cake are in every day use in making up boluses intended for immediate administration; and when made into a paste with water and a little oil form a good *luting* for distilling apparatus.

Linseed oil is got from the flax seed by expression, and, except in the case of the inferior qualities, without the aid of heat. It has a pale yellow colour, a mild but nauseous taste, and a specific gravity of about 930. When exposed to the air it speedily becomes rancid; but when in a thin stratum it quickly dries up, forming a hard transparent varnish, and hence its extensive use in the arts as a drying oil. It is insoluble in water, soluble in five times its weight of boiling alcohol, in about forty parts of cold alcohol, and in about one and a half of ether. Like other oils, it forms soluble compounds with alkalies. When mixed with an equal quantity of lime water it forms carron oil—a remedy once much used for scalds and burns. It is sometimes adulterated with rapeseed oil; but is more commonly of inferior quality from its being rancid, containing impurities, or its having been prepared with the aid of heat.

Actions and Uses.—Linseed oil is cathartic and emollient. Though less active as a cathartic than castor oil, it is more frequently used on account of its being considerably cheaper. It causes less irritation than most other purgatives, and hence is especially indicated in such cases of irritability of the intestinal canal as require the administration of medicine. It is often serviceable in arresting diarrhœa, by carrying down the crude undigested food, or other irritant matters, which so commonly produce that complaint. In virtue of its laxative and emollient actions, it is frequently of value in relieving irritant poisoning; is useful in cases where saline or active vegetable purgatives have been ineffectual, or where their repetition is deemed inexpedient; and is prescribed in colic usually along with stimulants and anodynes. For horses the colic draught usually given at the Edinburgh Veterinary College consists of one pint of linseed oil, with one or two ounces each of laudanum and oil of turpentine. On account of its lubricating and emollient properties, linseed oil is of much benefit in relieving cases of choking; is sometimes injected into the rectum and bladder to allay irritation of these organs; and is often applied as a soothing dressing to hard, dry, and irritable surfaces. It is often employed for making ointments and liniments; but on account of its drying properties is less suitable than olive oil or lard.

Doses, etc.—The dose, as a cathartic, for horses and cattle is from Oi. to Oij.; for sheep from f℥iij. to f℥vi.; and for dogs from f℥i. to f℥ij.

LIQUORICE ROOT.

Glycyrrhizæ Radix. Root of *Glycyrrhiza glabra.*

Nat. Ord.—Leguminosæ. *Sex. Syst.*—Diadelphia Decandria.

Liquorice grows in most countries of Continental Europe, thriving best on dry, light, sandy soils. The best qualities are grown in England, or imported from Spain or Italy. The plants vary from two to four feet in height, and have large, irregular yellowish-green leaves; papilionaceous white flowers; and long, creeping, fibro-fleshy, perennial roots, which are smooth, brown, cylindrical, and about the thickness of the thumb, arrive at perfection about the third year, have a peculiar sweet and somewhat sickly taste, and constitute the officinal part of the plant. To preserve them from moisture they are generally kept in sand. The powdered root has a yellow colour, a strong sweet taste, and is soluble in water, and also, though to a less extent, in alcohol. It contains starch, albumen, lignine, wax, various salts, a resinous oil, to which it owes its sub-acrid taste, a nitrogenous, crystallizable substance, and a sweet, yellow, uncrystallizable principle termed glycion or glycyrrhizine. The natural juice or watery infusion, when concentrated until it becomes solid, forms the well known extract of liquorice or black sugar.

Actions and Uses.—Liquorice resembles sugar in all its more important uses, whether dietetic or medicinal. It is serviceable as a demulcent and emollient, especially in irritation of the pulmonary mucous membrane in man; and is employed for making up boluses, and covering the disagreeable taste and odour of many drugs. In veterinary practice, however, it is generally superseded by treacle.

MAGNESIUM AND ITS MEDICINAL COMPOUNDS.

MAGNESIA. Calcined Magnesia. Oxide of Magnesium. Mg O.

Magnesia is usually prepared by heating the carbonate to redness in covered crucibles until its water and carbonic acid are expelled. It may also be got by adding caustic potash to a solution of any magnesian salt.

It is a white, odourless powder, with a slightly earthy taste, is very sparingly soluble in water, and has much affinity for moisture, but little for carbonic acid. Its density is about 3·, but varies somewhat according to the temperature at which it has been prepared, the lighter sorts being produced at the lower temperatures. It is sometimes impure from the presence of lime, silica, or carbonate of magnesia. Magnesia and its salts give negative results with sulphuretted hydrogen and hydrosulphuret of ammonia; a white precipitate with carbonate of potash; and a white precipitate with phosphate of soda, in the presence of ammonia or its carbonate.

Actions and Uses.—Magnesia is antacid and laxative, but is rarely used in veterinary practice. It is sometimes prescribed in doses of from ʒij. to ʒviij. for foals and calves troubled with indigestion; and is best given along with carminatives. In virtue of its antacid properties, it is an antidote for poisoning by the mineral acids. It removes arsenic from solution, is consequently one of the antidotes for that poison, and is best given in the form of a gelatinous hydrate made by adding caustic potash to a solution of the sulphate. Its laxative effect is scarcely appreciable in either horses or cattle, but is produced in dogs especially when used with jalap, calomel, or other purgatives. It is most conveniently given suspended in milk or gruel.

CARBONATE OR SUB-CARBONATE OF MAGNESIA. Magnesia alba. $4\,MgO, 3CO^2 + 4\,HO$.

Carbonate of magnesia is generally prepared by boiling carbonate of soda with bittern or with a solution of sulphate of magnesia, when double decomposition ensues, and the precipitated carbonate of magnesia is collected, washed, and dried. The heat used in preparing it drives off some carbonic acid, and hence the salt contains a portion of uncombined oxide. It is a white, odourless, tasteless powder, is very sparingly soluble in water, and more easily dissolved in cold than in hot water. It occurs of two different sorts—the one being dense, loose, and granular; the other lighter and more starchy looking.

In its actions and uses it is very analogous to magnesia itself; is antacid and laxative; and may be used in doses twice as large as those of the oxide.

SULPHATE OF MAGNESIA. Epsom salt. Magnesiæ Sulphas. $MgO, SO^3 + 7 HO$.

This important magnesian salt is found in various rocks, soils, and mineral waters. It has been long recognised as a constituent of the famous mineral streams of Epsom, whence it derives its vernacular name.

Preparation.—It is generally prepared from magnesian limestone, or dolamite, which is a mixed carbonate of lime and magnesia; or, from bittern, the oily looking liquid left when sea-water is concentrated for the separation of common salt. When prepared from the first of these sources, the following process is usually adopted:—The magnesian limestone is calcined to expel water and carbonic acid; the caustic lime and magnesia, so formed, are slaked with water; hydrochloric acid is added in sufficient quantity to convert all the lime into chloride of calcium, which is separated in solution, leaving the insoluble magnesia, which is then treated with sulphuric acid, and the sulphate of magnesia thus produced crystallized out. Bittern, when concentrated, yields an abundant crop of crystals of sulphate of magnesia; and still larger quantities are obtainable, by first adding some sulphuric acid to convert the chloride and other salts into the sulphate. These two processes are sometimes conjoined, the calcined dolamite being added to the bittern, the mixture heated with diluted sulphuric acid, and the solution concentrated until crystals separate on cooling.

Properties.—Epsom salt is usually sold in transparent, colourless, needle-like crystals; but, when slowly crystallized, may be got in large four-sided rhombic prisms. It has a cooling, saline, nauseously bitter taste; is insoluble in alcohol, but soluble in its own weight of temperate water, and in three-fourths of its weight of boiling water. When heated, it fuses in its water of crystallization; but, as the temperature is raised, the water volatilizes, and a colourless glass remains. It closely resembles sulphate of zinc, from which, however, it may be readily distinguished by its saline bitter taste; by its having no metallic astringency, and by its giving no precipitate, when dissolved in water, and treated with caustic potash. Epsom salt is distinguished from Glauber's salt by its neither efflorescing when exposed to the air, nor communicating any yellow colour to the flame of alcohol. From oxalic acid, for which it has been sometimes mistaken, it is easily distinguished, by its finer and more needle-like crystals, its bitter taste devoid of acidity, and by its precipitating alkaline carbonates without effervescence.

Actions and Uses.—Sulphate of magnesia, like other saline substances, is a tardy and uncertain cathartic for horses, and tends in them to act rather on the kidneys than on the bowels. Among dogs its purgative effect is slow and irregular, and often accompanied by nausea and vomition. For cattle and sheep, however, it is a most convenient and useful cathartic, being second only to common salt in rapidity and fulness of action. Among cattle, it usually operates in about twelve or fifteen hours, and in full doses causes very fluid evacuations. Although purgation is its most prominent effect, it also appears to augment the secretions of the kidneys and skin, and especially when given in moderate frequently repeated doses. It is given to ruminating animals for all the ordinary purposes of a purgative—to evacuate the bowels in indigestion, constipation, and many cases of diarrhœa; to remove noxious matters from the blood, as in febrile and inflammatory affections; and to induce extensive counter-irritation, as in inflammation of the brain, eyes, and most other organs, except the intestines. It is a useful antidote in cases of lead-poisoning, for it produces an insoluble sulphate, and also calls forth the action of the bowels, which, in these cases, is usually much impaired. In smaller and repeated doses it acts as a diuretic; but is seldom, if ever, used for that purpose. It is frequently used as a constituent of laxative clysters.

Doses, etc.—The dose, as a cathartic for adult cattle, is ℔j. to ℔ij.; for average-sized calves, of two to three months, ℥iij. or ℥iv.; and for sheep, from ℥iv. to ℥vi. Doses, amounting to about a fourth part of these, are often effectual in removing indigestion, and keeping up the action of other cathartics. Epsom salt should be given dissolved in ten to twenty parts of water. To remove its nauseously bitter taste, and render it more palatable, it may be given with a quantity of treacle, or with sulphuric acid, in the proportion of fifteen to twenty drops to every ounce of salt. To expedite its action, and prevent nausea and griping, some carminative should also be added, such as a drachm of ginger to every ounce of salt. To increase its effect, as is often advisable, when it is given in those cases of obstinate constipation and torpidity of the bowels, so frequently occurring among cattle, it may be advantageously united with twelve or fifteen croton beans, and its exhibition followed up by repeated doses of treacle and ginger.

MARSH MALLOW ROOT.

Althææ Radix. Root of *Althæa officinalis.*

Nat. Ord.—Malvaceæ. *Sex. Syst.*—Monadelphia Polyandria.

The plants of the natural family, *Malvaceæ*, are rich in mucilaginous matter, and most of them yield tenacious fibres, from which cordage is often obtained. The several species, *Gossypium*, are surrounded by delicate, twisted looking hairs, which constitute raw cotton. The marsh mallow, and more rarely the common mallow, are the plants of the family chiefly in request for their mucilaginous properties. The former grows both in this country and on the continent, generally in the neighbourhood of rivers and salt marshes. The flowers, stem, and leaves yield mucilage, but in lesser proportion than the root, which is consequently preferred. It is sold in light-coloured, fibrous, silky-looking pieces, several inches long; has a sweet, mucilaginous taste; contains about twenty per cent. of mucilage, with starch and a little sugar; and readily yields its properties to water.

Actions and Uses.—Marsh mallow root is very similar in its actions and uses to linseed and other mucilaginous substances. It is employed, both internally and externally, for all the purposes of a demulcent and emollient, in the various forms of drench, poultice, and fomentation; and is also occasionally used for making up boluses, emulsions, and other pharmaceutical preparations.

MERCURY AND ITS MEDICINAL COMPOUNDS.

MERCURY. Quicksilver. Hydrargyrum. Hg.

From its mobility and volatility, this metal has been aptly named after the messenger of the gods. To its silvery appearance, it owes its Latin synonyme hydrargyrum; and to its mobility and metallic lustre such appellations as aqua argentum, aqua metallica, and quicksilver. Although occasionally found in metallic globules, its most important source is the sulphuret, the cinnabar of mineralogists, chiefly obtained from Idria in Carniola, and Almaden in South America. When the ore is heated with iron or lime the mercury distils over, and is exported in cylindrical wrought-iron bottles, holding from 60 lbs. to 1 cwt. In 1840, 328,566 lbs. of mercury were imported into this country.

Mercury is easily distinguished by its mobility, liquidity, and silvery-white lustrous appearance. It is tasteless and odourless, freezes at—40°, and boils at 660°, forming a dense colourless gas. Its specific gravity at 60° is 13·5, and its atomic weight is now generally considered as 100. When triturated with fatty or saccharine substances, it loses its fluidity and globular structure, and becomes a dark grey powder. By this process of extinction, as it is called, the mercury is reduced to a state of fine subdivision, and a small portion is probably also oxidised. Mercurial ointments, liniments, and some other compounds, are made in this way.

Chemical Tests.—Mercury itself is easily identified by the characters already mentioned, and its several compounds are distinguishable by the following tests. When slightly heated in a test tube with dry carbonate of soda, they undergo decomposition, their metallic portion volatilizing, and condensing in the cool part of the tube in minute metallic globules. All compounds of mercury in solution, when treated with a solution of protochloride of tin, yield white precipitates, which, as the precipitant is slowly added, become grey, and then almost black, owing to the calomel first thrown down being gradually reduced to the metallic state. All the lower or sub-salts of mercury, that is, all the compounds of the black oxide, as calomel or the sub-nitrate, when dissolved, and treated with sulphuretted hydrogen or hydro-sulphuret of ammonia, give black precipitates of the sulphuret (HgS); with potash and lime water, black precipitates of the oxide (Hg^2O); and with iodide of potassium, a green precipitate of sub-iodide of mercury (Hg^2I). All the higher or proto-salts of mercury, that is, all the compounds of the red oxide, as corrosive sublimate or the higher nitrate, when dissolved, and treated with sulphuretted hydrogen, give a precipitate which is at first yellow, but on continued addition of the precipitant, passes through the various shades of brown to black; with caustic potash and lime water, yellow precipitates of the hydrated red oxide ($Hg\ O$); and with iodide of potassium, the brilliant carmine-red iodide ($Hg\ I$).

Actions and Uses.—So long as mercury remains uncombined with oxygen, acids, or salt radicles, it is, like other metallic substances, devoid of physiological action. It has been given to the human subject in doses of several pounds, for the purpose of removing obstruction of the bowels, and exerts only a mechanical effect. When given, however, in a state of fine division, it readily unites with oxygen, and is thus endowed with very active properties. In this way mercurial vapours, in themselves innocuous, speedily become, by exposure to the air, powerfully poisonous, as is well illustrated by the following case:—"In 1810, the 'Triumph' man-of-war and 'Phipps' schooner received on board several tons of quicksilver, saved from the wreck of a vessel near Cadiz. In consequence of the rotting of the bags, the mercury escaped, and the whole of the crews became more or less affected. In the space of three weeks, two hundred men were salivated, two died, and all the animals, cats, dogs, sheep, fowls, a canary bird—nay, even the rats, mice, and cockroaches, were destroyed." (Pereira, vol. i., p. 813).

With metallic mercury, however, veterinarians have little to do. But many of its compounds are of much interest both as medicines and poisons. Their actions are very various. The nitrates and the higher chloride, better known as corrosive sublimate, are powerfully irritant and corrosive. The peroxide and lower sulphate are astringent. Many of the compounds are cathartic, such as calomel and blue pill. Some, as the perchloride, are believed to act on the kidneys. Most of them are antiphlogistic, and all capable of producing that peculiar state of body called *mercurialism*. The symptoms of mercurialism are tolerably uniform in all animals. Secretion and excretion become increased. The saliva is especially augmented, but this is not observable to the same extent amongst the lower animals as in man. Large quantities of fæces are passed, containing much mucus and bile. The kidneys and skin are also unusually active. The mouth becomes tender, the gums red and swollen, and the breath fœtid. The pulse is usually somewhat accelerated. There is impaired appetite, with nausea, gradual loss of condition, and general weakness. During the continuance of this peculiar condition, the blood undergoes some changes in composition, becomes more serous and less fibrinous, contains fewer red globules, and a fœtid oil, and is very prone to decomposition. Various curative actions are also developed. Anasarcous swellings are removed, and glandular enlargements or indurations diminished, and often entirely dissipated. Acute inflammation is mitigated or subdued, whilst exudation of lymph is arrested. Such beneficial effects are especially observable in pleurisy, rheumatism, liver complaints, and inflammation of the eye, and where the administration of mercurials has been preceded by blood-letting. It must, however, be remarked, that amongst the lower animals the antiphlogistic action of mercurials is somewhat less certain and effectual than in man. Mercurialism may be produced in all animals, but with more difficulty in horses and cattle than in dogs and cats. It occasionally follows the exhibition of one large dose, in which case it is unusually violent and difficult to control. It is induced most certainly and safely by small and repeated doses of calomel or any of the milder preparations of the base, and its production is expedited by using the medicine both externally and internally, and by employing blood-letting, nauseating medicine, or other means which diminish vascular tension and favour absorption. Whilst mercurialism continues, the patient must be carefully protected from cold and wet. When it is to be arrested, the administration of the mercurial must be suspended, a saline purge exhibited, and the mouth, if sore, repeatedly washed with a solution of alum or borax.

MERCURIAL OINTMENT. Unguentum Hydrargyri.

Mercurial or blue ointment of good quality cannot be made on the small scale without immense labour and loss of time. The wholesale manufacturer prepares it in the following manner. The materials, consisting of equal weights of mercury and hog's lard, "are kept in the fluid state by a temperature about 100°, and are driven round with rapidity in a circular trough by two spherical iron balls, which are propelled by means of a steam-engine; and in this way extinction is accomplished in the course of twelve hours." (Christison's Dispensatory). The process is facilitated by adding to the materials a sixteenth part of old ointment. The quality and purity of mercurial ointment may be conveniently judged of by comparing its colour, which is bluish-grey, with that of a specimen of known purity; estimating its specific gravity, which, according to Pereira, should be 1.78; and observing, with a magnifying lens of four powers, whether the metallic globules be extinguished. So long as they continue visible with such a glass, the ointment must be considered as imperfectly prepared. Another simple test is to remove the fatty matters by boiling water, when the residue should be half the weight of the ointment first taken. For most purposes, this ointment is too strong, and may be conveniently diluted with two or three parts of hog's lard or soft soap. All good mercurial ointment contains about one-fifth of its mercury in the state of oxide united with a fatty acid, and this proportion is probably increased when the ointment is applied to the skin with infriction and exposure to the air. The activity of the preparation is believed to depend wholly on the oxidised portion (Christison), metallic mercury being, as already mentioned, altogether devoid of action.

Actions and Uses.—Mercurial ointment when merely laid on the surface of the skin, acts very slightly, but when applied with smart friction it induces topical irritation and even vesication. It is used in all the domesticated animals as a remedy for mange, surfeit, and other scurfy skin diseases, being generally applied along with tar and sulphurous ointments. It is occasionally used to destroy vermin affecting the skin, but is not, in this respect superior to many milder and safer remedies. It is a very efficient stimulant dressing for indolent sores and ulcers, and a useful counter-irritant for chronic swellings. As it becomes slowly absorbed, it is sometimes applied over a large extent of surface to aid in producing the constitutional effects of mercury. On account of this property it requires to be used cautiously when a topical effect is alone desired.

MERCURIAL LINIMENT. Linamentum Hydrargyri.

It is made by diluting the ointment with about its own weight of lard or oil, and usually adding besides, some rectified spirit and aqua ammoniæ. Its effects are similar to those of the ointment.

MERCURIAL PLASTER. Emplastrum Hydrargyri.

The Edinburgh College gives the following directions for preparing mercurial plaster:—"Take of mercury, three ounces; litharge-plaster, six ounces; olive-oil, nine fluid drachms; resin, an ounce. Melt the resin and oil, let them cool, add the mercury, triturate till the globules disappear, add the plaster previously melted, and mix the whole well."—(Ed. Phar.)

It is occasionally used as a stimulant application for discussing glandular and chronic enlargements.

MERCURY WITH CHALK OR MAGNESIA. Hydrargyrum cum creta vel Magnesia.

These mixtures are made by triturating together three ounces of mercury with five ounces of chalk or magnesia. Both preparations are laxative and antacid. They are also said to be alterative, and have been recommended for dogs in doses of from five to ten grains.

MERCURIAL OR BLUE PILLS. Pilulæ Hydrargyri.

These pills, though much used in human medicine, are not employed in veterinary practice. They contain two parts of mercury, one of liquorice root, and three of conserve of red roses. The addition to this of about one part of sesquioxide of iron, produces a pill mass which has been recommended by Mr Morton as an alterative for horses in doses of from half a drachm to a drachm.

BLACK OXIDE OF MERCURY. Hydrargyri Suboxidum. Hg^2 O.

The black, grey, or lower oxide of mercury is prepared by decomposing calomel (Hg^2 Cl) with a solution of an alkali or an alkaline earth. It is a heavy black powder, devoid of taste or odour, and insoluble in water and alkalies, but soluble in nitric and acetic acids. It is unstable, and readily decomposed on exposure to light. It is little used either in human or veterinary practice, is milder than most other mercurials, and forms a series of salts which are less soluble, and consequently less active, than the corresponding salts of the higher or red oxide. The black oxide is chiefly used in the form of a lotion, known as the black wash, and used as a stimulant for unhealthy sores and chancrous ulcers.

RED OXIDE OF MERCURY. Hydrargyri Oxidum. Hg O.

The red, yellow, or higher oxide of mercury, also known as red precipitate, is prepared by decomposing corrosive sublimate (Hg Cl) with lime water, or by heating nitrate of mercury (HgO, NO^5) until acid fumes cease to be evolved. Prepared by the former process, it occurs in a hydrated state, has a yellow or brown colour, according to the proportion of the ingredients used, and constitutes the yellow wash of surgery. Obtained by the latter method, it occurs in bright scarlet scales, which become yellow when powdered, and brownish-black when heated, recovering, however, their original colour on cooling. It is dissolved sparingly in water, but readily in hydrochloric acid. It is devoid of odour, but has a metallic acrid taste. It is greatly more active than the black oxide, causing fatal gastro-enteritis when given to dogs in doses of a few grains. Four grains are mentioned by Orfila as having destroyed a dog in eighteen minutes. It is used externally for the treatment of indolent ulcers, luxuriant granulations, unhealthy eruptions and chronic tumours, being applied in the various forms of powder, lotion, or ointment.

SULPHURET OF MERCURY. Hydrargyri Sulphuretum. Hg S.

Sulphuret of mercury occurs in two different conditions, as cinnabar, a red brown substance found in Carniola and Spain, either in an amorphous or crystalline state, and constituting, when powdered, the beautiful, bright scarlet vermilion; and as Ethiops mineral, a heavy black powder, got by triturating together equal weights of mercury and sulphur. Both of these are insoluble and nearly inert. The latter used to be employed by the old farriers as an anthelmintic and a specific for glanders, and was given to horses in doses of ʒi. to ʒiij. It has, now, however, deservedly fallen into discredit.

SULPHATE OF MERCURY. Turbith Mineral. $3HgO, SO^3$.

Subsulphate of mercury is the only one of the four sulphates of this base which possesses any medicinal interest. It is prepared by triturating the higher sulphate with warm water, and is a heavy, inodorous, insoluble, yellow powder, with an acrid taste.

It was once frequently used as a remedy for glanders and farcy, as an emetic for the dog, and on account of its actively irritant properties, as an errhine; but for these and all other purposes, it is now justly superseded by safer and more certain remedies.

CALOMEL. Subchloride of Mercury. Hydrargyri subchloridum. Hg^2 Cl.

Calomel is found native in Carniola and Spain, but in too small amount to be of any commercial value. The large quantities used in medicine are obtained either by decomposing a solution of the nitrate with a hot solution of common salt, or by subliming a mixture of the lower sulphate and common salt.

The latter process is that usually preferred, and is best conducted in the following manner :—Two equal quantities of mercury are taken. One of these is heated with a little nitric acid and a sufficiency of sulphuric acid to form the protosulphate of mercury (HgO, SO^3), which is dried and triturated with common salt and the remaining portion of the mercury. The mixture is then introduced into appropriate subliming vessels and heated. The calomel rises in the state of vapour, and is either condensed in dome-shaped receivers, or more commonly conveyed into large chambers, where it is precipitated as a fine impalpable powder, and subsequently washed with cold water, to remove any traces of corrosive sublimate. The chemical changes which occur in this process are very simple ;—the protosulphate of mercury being triturated with as much mercury as it already contains, thus becomes converted into a subsulphate (Hg^2O, SO^3), and this when heated with chloride of sodium ($NaCl$), is decomposed, the mercury uniting with the chlorine of the salt to form calomel ($Hg^2 Cl$), and the other elements forming sulphate of soda.

Properties.—Calomel differs somewhat in its properties, according to the mode of its preparation. When obtained by precipitation it is usually not quite pure, but contains a trace of metallic mercury. When sublimed and condensed in receivers, it has a fibrous, horny, crystalline structure, a sparkling lustre, and a yellowish-white colour, both in powder and mass. When sublimed and condensed in large chambers, it is pure white, and very finely divided. It is inodorous, tasteless, and insoluble in cold water, alcohol, and ether; but is partially decomposed into metallic mercury and corrosive sublimate, by boiling water, especially when rich in salts, and by potash, soda, and lime. At a red heat it volatilizes, but at lower temperatures it becomes yellow, regaining, however, its original appearance when allowed to cool. Its specific gravity is nearly 7·2.

Impurities.—Although many dread the admixture of corrosive sublimate, it appears to be very rarely present. The minutest trace is readily dissolved out by agitating the calomel with cold water, and testing this solution with sulphuretted hydrogen, caustic potash, or lime water. Sal-ammoniac, which is occasionally present, is discoverable by its taste ; while all common inorganic impurities are easily detected on account of their being left when the calomel is volatilized by heat.

Actions and Uses.—Calomel is irritant, stimulant, sedative, and antiphlogistic ; is capable, like other compounds of the base, of causing mercurialism ; and in passing out of the system by the various emunctories, acts, in virtue of its irritant properties, as a cathartic, cholagogue, diuretic, diaphoretic, and sialogogue.

The irritant properties of calomel are greatly inferior to those of corrosive sublimate, and most of the other proto or higher salts of mercury. They are developed, however, along with the usual symptoms of mercurialism, when the medicine is given in doses varying from ʒiij. to ʒvi. to horses ; from ʒi. to ʒij. to cattle ; from grs. xv. to grs. xxx. to sheep ; and from grs. vi. to grs. xxx. to dogs. Hertwig found that such doses given to these animals caused in about twenty-four or thirty-six hours, and in dogs in less time, occasional colic and copious excretion of feces, which contained considerable quantities of bile, and were greyish green in cattle, but black in dogs. Such doses, when repeated three or four times, and especially if continued for several days, further induce thin and stinking evacuations, fœtor of the breath, soreness of the mouth, rapid impairment of the appetite and condition, and fatal low fever and dysentery. At the Edinburgh Veterinary College, in June 1853, a healthy donkey got a drachm of calomel daily in three separate doses. About the sixth day the animal became excitable, and the pulse rose to about 85. By the eighth day the secretion of saliva was augmented, the breath became fœtid, the gums red and tender, and the appetite impaired ; but nothing abnormal was observed in the quality of the feces or urine. By the twelfth day, these symptoms became more aggravated ; the pulse softer and less frequent, indicating the sedative action which renders calomel so useful for many curative purposes ; and the strength much reduced. On the fourteenth day, the administration of the calomel was suspended ; but death occurred two days afterwards. The animal had received fourteen drachms in fourteen days. On post-mortem examination the teeth were found quite loose, the mucous membrane of the mouth and air-passages blanched, while that of the stomach and intestines was softened, easily torn, and in many places thickly covered with mucus and epithelium. The liver was rather friable, but the kidneys, spleen, and lungs were healthy. Hertwig considers that dogs and swine, on account of their often getting rid of the medicine by vomiting, are less easily affected than the other domesticated animals; and that horses are less susceptible than cattle.

There is no doubt that the absorption of calomel necessarily precedes the production of its general actions; but the manner in which it is dissolved, and so fitted for absorption, and the particular changes it subsequently effects on the blood and animal solids are as yet very imperfectly understood.[1] When given in small and repeated doses it appears to accelerate the normal processes of change ever going on within the body, to increase the activity of secretion and excretion, and to cause absorption of adipose and other liquifiable deposits. These are what are usually styled the alterative effects of the drug; but as they differ in no respect from the stimulant effects, there is no advantage in using a term which is so meaningless and liable to abuse. The action of calomel on the various excreting organs is not difficult of explanation. By one or more of these it is separated from the blood, and appears to have a greatly more extended choice as to the channel of its excretion than most other medicines. Like other irritants, however, it produces during its elimination increased activity of the excreting organ.

Few substances have been applied to so many and diversified uses as calomel; but I shall notice here those only which are of recognized importance. It is employed in almost all animals in

[1] It has been supposed by many that calomel owes its activity to its being converted into corrosive sublimate by the hydrochloric acid, and chlorides of the alimentary canal. This, however, has been disproved by Dr G. Oettinger. He found that the alkaline chlorides in the alimentary secretions were in too minute quantity, and too diluted to have any decomposing action on calomel; and that the gastric juice was also devoid of any power of converting calomel into corrosive sublimate. He ascribes, however, to the albuminous matters of the stomach, a slight solvent action on calomel.—*See Monthly Journal of Medical Science*, 1851, p. 88.

reducing and controlling acute inflammations; and appears especially serviceable in those affecting the serous membranes, as in pleurisy, common and puerperal peritonitis, iritis, and rheumatism. In such cases it probably owes its good effects in great measure to its impoverishing the blood, weakening the action of the heart, and promoting secretion. To effect these purposes it must be given at intervals of two or three hours, and combined with opium or some other drug which will retard its excretion. It is frequently prescribed in jaundice and other chronic affections of the liver, accompanied with impaired action of that gland; in inveterate skin diseases; and in some dropsical affections; in all of which it should be used in small and frequently repeated doses, until the early symptoms of mercurialism present themselves. The occurrence of such symptoms indicates that the system has become saturated with the drug, and that the administration should either be immediately suspended, or continued only with extreme caution. In large doses, conjoined with opium, it has been used both in the human subject and the lower animals in the treatment of acute diarrhœa, dysentery, and enteritis; and in such cases is said to produce a marked sedative instead of an irritant effect. The success of such treatment more probably, however, depends on the calomel clearing the bowels of crudities; but the practice is too hazardous to be commended. Calomel is occasionally employed as an emetic for the dog; but unless given in combination it sometimes fails to act either with speed or certainty, and usually causes purgation as well as vomiting. When united with ordinary cathartics, it is of much value in obstinate constipation and torpidity of the bowels, particularly in cattle. In these animals it is usually combined with croton or salts; in horses with aloes; and in dogs with jalap. In establishing these actions, it is thought to act also on the liver; and M. Buchein has detected calomel in the increased biliary secretion of dogs to which the drug has been administered. (Headland). As an anthelmintic it is valuable only on account of its active purgative properties, and is therefore best given along with a cathartic, or a few hours before one. Its diuretic and diaphoretic actions are not applied to any therapeutic purposes, and are only decidedly developed when it is given with medicines which themselves produce such effects. The use of calomel, especially in doses adequate to induce mercurialism, is to be avoided in all malignant diseases, in erysipelatous inflammation, and in most typhoid and asthenic affections. It is occasionally used externally for removing mange and other cutaneous affections, and is one of the best remedies for thrush.

Doses, etc.—The dose, as an antiphlogistic and stimulant for horses and cattle, is from ℈i. to ℈iij.; and for dogs, from grs. ij. to grs. iij. Such doses must be given three or four times a day, or oftener, and along with opium or belladonna, to prevent their passing off by the bowels. As a cathartic it is never used alone; and the dose must consequently be regulated by the amount of the other purgatives with which it is combined. A drachm of calomel, with four drachms of aloes, is a full purgative for the horse; from one to two drachms, with a pound of Epsom or common salt, a pint and a half of oil, or twenty croton beans, for cattle; and three or four grains, with one or two scruples of jalap, for the dog.

CORROSIVE SUBLIMATE. Chloride of Mercury. Muriate of Mercury. Hydrargyri Chloridum. HgCl.

Corrosive sublimate and calomel must be carefully distinguished from each other. Both are chlorides of mercury; and, owing to an unfortunate difference of opinion respecting the combining equivalent of their base, are apt to be described by different chemists under the same scientific name. Corrosive sublimate, however, contains twice as much chlorine as calomel, and is now generally regarded as the protochloride of mercury (Hg Cl). It is an easily soluble and actively corrosive poison. Calomel, or the lower chloride, is now considered a subsalt (Hg^2Cl); and is an insoluble and comparatively mild and innocuous body. By using, whether in speaking or writing, the vernacular names of these two chlorides, all risk of mistake may be effectually guarded against.

Preparation.—Corrosive sublimate may be prepared by heating metallic mercury in chlorine gas, or dissolving it in hydrochloric acid. The most common process, however, consists in subliming a mixture of persulphate of mercury and common salt.

Properties.—It occurs either as a dense white powder, or in white, semitransparent, crystalline masses. It has no odour, but an acrid, disagreeable metallic taste. It has a specific gravity of 5·2, and is brittle, fibrous, and easily pulverised. When heated it fuses, and afterwards rises as an exceedingly acrid, poisonous gas. It is very soluble both in alcohol and ether, and dissolves in three parts of boiling water, and eighteen of cold water. It has an acid reaction on colouring matter, and forms flaky precipitates with albuminous matters. A sufficient number of tests for corrosive sublimate have been already mentioned; but the following deserves to be noticed on account of its simplicity and delicacy. When a drop of a solution of corrosive sublimate is placed on a sovereign or other piece of gold, and a key or some convenient piece of iron applied, so as to touch at the same time the gold and the solution, a current of electricity is produced, which decomposes the corrosive sublimate, and precipitates its mercury on the gold as a black stain, easily removable by heat.

Impurities.—Corrosive sublimate is not subject to intentional adulteration. When pure it is free from colour and moisture, leaves no residue when heated, and is entirely soluble in water, alcohol, and five or six parts of ether.

Actions and Uses.—It is an active irritant and corrosive; and is used internally as an antiphlogistic, and externally as a caustic and stimulant.

Large doses of corrosive sublimate induce in carnivora vomiting, and in all animals uneasiness, colicky pains, tenderness of the abdomen, evacuation of bloody feces, a small, wiry, and accelerated pulse, short and difficult breathing, nausea and prostration of strength with occasional convulsions—in short, all the symptoms of acute enteritis or dysentery. Doses of grs. vij. or grs. viij. destroyed dogs in seven, twelve, or thirty hours; ʒiv. dissolved in water killed a horse in twelve hours; ʒij. caused in cattle great emaciation and death in fourteen days; and ʒi. proved fatal to a sheep within twelve hours. (Hertwig). On post-mortem examination the stomach and lower intestines are found disorganised by the chemical action of the poison, and also inflamed and ulcerated, except where death has occurred before the establishment of vital reaction; the kidneys and other urinary organs are unusually vascular ; the lungs spotted with effused blood; and the heart occasionally inflamed, and filled with blood, thus indicating a state of paralysis which probably depends on derangement or depression of the nervous system. (Moiroud). Similar effects are observed when the poison, in the quantities above mentioned, is placed within the cellular tissue or injected into the veins. In small and repeated doses, corrosive sublimate speedily induces violent mercurialism.

The best antidote for corrosive sublimate is albumen, which combines with it to form an insoluble and inert albuminate of mercury, and is besides, useful as a demulcent. It is best given in the form of white of egg. The white of one egg is said to be sufficient to counteract the effects of four grains of sublimate. When eggs cannot be had, wheat or barley flour, milk, or other albuminous substances, must be given, followed up by astringent solutions.

On account of its violently irritant properties, corrosive sublimate is rarely used internally. Without the slightest show of reason, or hope of success, it has been recommended in doses of from four to eight grains, for the cure of glanders and farcy, inveterate skin diseases, and "chronic engorgements." It is used externally for the cure of exuberant granulations, indolent ulcers, and fistulæ. It has been recommended as a valuable means of preventing the escape of synovia from open joints; but, in such cases, the rational treatment consists in keeping the limb perfectly fixed, and reducing irritation of the injured parts by light, cold water dressings. All devices for plugging up the orifice, and all synovia-coagulating matters, are quite useless, and usually very injurious. It is occasionally employed in the form of solution, as a stimulant for mange, scab, and such like complaints, and as a poison for lice and other vermin infesting the skin; but, if used for such purposes, it must be with much caution, since it is very apt to become absorbed, and induce serious and even fatal results. The solutions in common use generally contain from four to six grains of corrosive sublimate to the ounce of water.

Iodides of Mercury. Hydrargyri Iodida.

The lower or green iodide corresponds to calomel, having the composition Hg^2 I., is prepared by adding iodide of potassium to calomel, or any subsalt of mercury; and has considerable activity as an irritant, a scruple destroying a rabbit within twenty-four hours, and a drachm a pointer dog in five days.—(Cogswell).

The proto or red iodide, (HgI), is usually met with as a bright red, heavy, inodorous powder, with a disagreeable metallic taste. It is insoluble in water, but soluble in acids, iodide of potassium, and most saline solutions. It is easily prepared by triturating mercury and iodine with a little rectified spirit, boiling the mixture in a concentrated solution of common salt, and allowing it to crystallize slowly.—(Ed. Phar.) It resembles other mercurials in its effects. It is less active than corrosive sublimate, but more active than calomel. A scruple, given to a rabbit, induced enteritis, and death in twenty-four hours. It is not used internally, but is sometimes applied externally as a caustic and stimulant for unhealthy wounds, chronic indurations, and ossific deposits. For such purposes, it is generally used in the form of an ointment, which may be conveniently made with one part of iodine to eight of lard.

Citrine Ointment. Ointment of the Nitrate of Mercury. Hydrargyri nitratis unguentum.

Citrine ointment is the pharmaceutical imitation of the famous empirical preparation known as the Golden Eye Ointment. Mr Duncan, of Messrs Duncan, Flockhart, & Co., chemists, Edinburgh, first discovered the secret of preparing good citrine ointment, capable of being kept for any considerable length of time, and recommends it to be made as follows:—Take four ounces of mercury, twelve ounces of nitric acid, of density 1380 to 1390, thirty-two ounces of olive oil, and fifteen ounces of lard—all by avoirdupois weight: mix the mercury with the acid, and let the mixture stand for several hours. Melt and strain the lard; and while it is yet hot (at about 180° or 190°), add the nitrate of mercury, and stir with wooden spatulæ until the ointment assumes its proper colour. When a less active preparation is required, the amount of mercury may be reduced to a half or a fourth, still using, however, the same quantity of nitric acid.—(See Christison's Dispensatory). Mild ointments, when made by diluting the strong citrine ointment with lard, are only fit for immediate use, since they become decomposed, and alter in colour within a few days.

Properties.—Well prepared citrine ointment has a golden yellow colour, an unctuous consistence, a nitrous acid odour; and retains these characters for a long time if kept in earthenware or glass vessels, secluded from light. When badly prepared, or much exposed to light, it speedily, however, becomes of a greyish-green colour, hard, brittle, and easily pulverised. This is believed to depend on the lard depriving the nitrate of mercury of oxygen, and so reducing portions of it to the metallic state. Such changes are best prevented by preparing the ointment with excess of nitric acid, which oxidises the lard, and so prevents its appropriating the oxygen of the nitrate of mercury. Citrine ointment, when injured by long keeping, regains its original characters if heated with nitric acid.

Actions and Uses.—Citrine ointment is chiefly used as a stimulant in chronic skin complaints, unhealthy sores, and ophthalmia. It appears to be tolerably easily absorbed, and if applied over a large extent of surface induces the usual constitutional effects of mercury.

MURIATIC OR HYDROCHLORIC ACID.

Spirit of Salt. Acidum Muriaticum. HCl.

Hydrochloric acid is prepared by distilling together equal weights of common salt, sulphuric acid, and water. The strong liquid acid of the shops contains about 36 per cent. of the pure gaseous acid (HCl), and has usually a yellow colour which may, however, be removed by diluting and redistilling it, a density of 1180, a sour taste, and a pungent odour. It is readily distinguished by its yielding, with nitrate of silver, a white precipitate, insoluble in nitric acid but soluble in ammonia. From careless preparation it sometimes contains sulphuric acid, nitrous acid, chlorine, and iron—impurities which interfere with some of its more delicate pharmaceutical uses, and are easily discovered by their special tests.

Actions and Uses.—Hydrochloric acid is exactly analogous to sulphuric and nitric acids in its actions and uses. In large doses it is irritant and caustic; in medicinal doses tonic; and is also used externally as a caustic, astringent, antiseptic, and occasionally as a disinfectant.

Doses, etc.—The dose is about fʒi., or fʒij., for horses and cattle; and from gutt. ij. to gutt. v. for dogs. It is given diluted with water.

MUSTARD.

Sinapis. Flour of the seeds of the *Sinapis nigra*.

Nat. Ord.—Cruciferæ. *Sex. Syst.*—Tetradynamia Siliquosa.

The mustard plant is an annual about two feet high, with yellow cruciform flowers, and pods containing several brown seeds. It is indigenous in all parts of Europe, and is extensively cultivated in many parts of Durham and Yorkshire. A wild variety abounds in the corn-fields in most parts of the country; is familiarly known under the names of charlock and kellocks; and is sometimes used for adulterating the better sorts. The pharmacopœias recognise two kinds of mustard seed—the black and the white. The former is a dark-brown seed, about the size of the millet, and with a greenish-yellow powder, which has a pungent oily taste, a slightly nauseous odour when dry, and a powerfully irritant flavour when moistened. The seeds of the white mustard are lighter in colour, larger in size, and considerably less pungent and irritating. The mustard of the shops is a mixture of both these two kinds, and, according to information given to Professor Christison by an English manufacturer, is made in the following manner:—" Two bushels of black, and three of white seed yield, when ground, 145 pounds of flour; which, to diminish the pungency and improve the colour, is mixed with fifty-six pounds of wheat-flour, and two pounds of turmeric; and the acrimony is restored without the pungency, by the addition of a pound of chilly pods and half a pound of ginger. Black seed alone, it is added, would be much too pungent for use at table. Wild mustard-seed is sometimes substituted for the black species if the latter be scarce. Some manufacturers remove the fixed oil from both the white and black seed, by means of expression, before making them into mustard flour with the other ingredients; and the acrimony of the product is thus increased."—(Christison's Dispensatory).

The principal constituents of mustard are,—a fixed oil very similar to that of rape-seed; a crystalline fatty matter called sinapisine; myronic or myroxic acid (in combination with potash); a bitter uncrystallizable substance, not as yet very fully studied; and myrosine, an albuminous principle closely resembling the emulsine of bitter almonds, and which, in presence of air and moisture, has the property of causing a peculiar fermentation of the myronic acid, and the consequent development of a peculiar volatile oil. This oil is colourless, a little heavier than water, boils at 300° Fahrenheit, and is the principle to which all the preparations of mustard owe their characteristic properties. Its formula is $C^8 H^5 N S^2$. The seeds of the white mustard, as above stated, are less powerful than those of the black; and this depends upon their containing no myronic acid, and being in consequence incapable of yielding any volatile oil.

Mustard is scarcely ever pure, for commercial specimens contain, as above noticed, starch and various aromatics. The starch may be readily detected, in a solution made with warm water, by adding, after it has cooled, a little iodine, when the characteristic blue iodide of starch will be produced. These admixtures greatly diminish the efficacy of the pure black mustard, especially as a counter-irritant. Inorganic impurities, which are occasionally present, may be easily detected by their remaining after burning.

Actions and Uses.—Unbruised mustard-seeds have but little effect when swallowed, probably because they are very partially digested. The flour, however, acts in large doses as an irritant, and in medicinal doses as a stomachic and carminative. Some practitioners believe it to have laxative properties; but most consider that it renders the feces hard and dry, and slightly increases the secretion of urine. A dessert spoonful dissolved in several ounces of water, and given to the dog, causes vomiting; but mustard is rarely given internally, either for this or any other purpose. It is, however, much used externally as a counter-irritant; and may be applied so as to act either as a mild rubefacient or a powerful suppurant. When made into a paste with water, and applied to the skin, the part soon becomes red, hot, and tender, and the animal restless and uneasy. When applied in considerable quantity, and with smart friction, the epidermis, after three or four hours, is separated from the true skin by effusion of serum, producing numerous small vesicles, which speedily run on to suppuration. The surrounding parts also become swollen. The skin generally heals up in about a week. Occasionally, however, from the injudicious use of the agent, the true skin is actively inflamed, sloughing occurs, and the hair seldom reappears, or does so only after a long time. As compared with cantharides, the action of mustard is more prompt; but its effects, though sometimes violent, are not usually so permanent. It causes less exudation of serum, but more swelling of the surrounding parts. When applied repeatedly, especially to the extremities of the horse, it is more apt to affect the deep-seated parts, and hence produce sloughing; but, unlike cantharides, it has no tendency to act upon the kidneys. Mustard is more suitable as a blistering agent for cattle than for horses and dogs. It often acts on the thick and insensible hides of cattle when other agents would have little effect, and seldom causes permanent injury or blemishing. It relieves deep-seated pain and inflammation by producing antagonism or counter-irritation; or, in other words, by causing a superficial and manageable inflammation, which withdraws a large amount of the superfluous blood and nervous influence which were previously determined towards the more deep-seated and serious disease. The special applications of mustard are not very different from those of cantharides. It is employed in bronchitis, pleurisy, and sometimes, but usually with less advantage, in pneumonia. It is often of service in chronic rheumatism, especially amongst cattle; in inflammation of joints, indurations of external parts, especially of glands; and as a stimulant for chronic unhealthy wounds. It is occasionally applied to overcome stupor and cerebral congestion, such as occur in the human subject in apoplexy and poisoning by opium, and in cattle in the later stages of the apoplectic form of puerperal fever. Many practitioners use it for determining the secretion of pus, and for maintaining or increasing the effects of cantharidine applications; but considerable caution is generally necessary in applying the one irritant soon after the other. Mustard applications are specially indicated where it is desirable speedily to induce extensive counter-irritation, and at the same time to avoid the chance of stimulating the kidneys. Hence it is often eminently suitable as a counter-irritant in those cases in which the urinary organs are in an unduly exciteable state. Mustard blisters, and indeed blisters of all kinds, must be carefully avoided so long as the parts to which they are applied continue in a state of inflammation. Unless this be attended to, extreme disorganization and sloughing will almost certainly ensue.

Doses, etc.—Mustard is administered as a stomachic, carminative, and mild stimulant in the following doses:—For the horse, from ʒiv. to ʒvi.; for cattle, ℥i.; and for the dog, from grs. x. to grs. xx. In dogs larger doses, especially in solution, act as emetics. To prevent its irritant action on the fauces, it is best given in the form of a pill or electuary, and may be administered either alone or in combination. Mustard is used as a counter-irritant in the several forms of paste, plaster, and poultice. The paste is made with water, which should be tepid, but not hot; with oil of turpentine; or, when still greater activity is required, with a mixture of equal parts of oil of turpentine and strong ammonia. Besides other solvents, vinegar has been recommended, but it is less effectual than water. A paste made with water alone produced in six minutes effects similar to those which it required fifty minutes to produce with the same mustard made up with vinegar instead of water. Mustard preparations are generally applied directly to the skin, being rubbed in with smart friction. Sometimes, however, they are spread upon linen or calico, and applied in the form of a plaster, but this is a far less convenient and effectual way of using them. Mustard poultices are recommended by the London and Dublin Colleges to be made with equal weights of mustard and linseed meal, and a sufficiency of vinegar. But for veterinary practice these preparations are nearly useless. They contain so much linseed meal that their action in ordinary circumstances is scarcely appreciable, while their activity is still further diminished by the injudicious addition of the vinegar. To ensure the full effect of mustard preparations the parts to which they are applied should be previously freed of hair, either by shearing or clipping, and also scalded with hot water—a preliminary operation which is especially essential in the treatment of the internal diseases of cattle.

The *volatile oil of mustard*, prepared by macerating and distilling the seeds, has been used as a vesicant, and acts very promptly and powerfully. Two drachms rubbed into the skin of a dog caused immediate irritability of the parts, and the speedy formation of large vesicles, surrounded by a violently inflamed tumour. It is applied dissolved either in spirit or in any of the fixed oils.

MYRRH.

Myrrha. Gummy resinous exudation probably of *Balsam-odendron Myrrha.* (Nees).

Nat. Ord.—Terebinthaceæ. *Sex. Syst.*—Octandria Monogynia.

Myrrh is the gummy resinous exudation of an Arabian shrub having spiny branches, ternate leaves, and an oval-shaped fruit. It is imported to this country in large chests from the coasts of the Red Sea, and chiefly by way of Bombay. It is believed to be one of those substances which the Israelites used for frankincense. It exudes spontaneously from cracks in the trunk or branches, and also from perforations and bruises ; is at first of an oily consistence, and of a yellow-white colour ; but gradually becomes as solid as gum, and of a brown-red tint. The best sorts of myrrh (generally termed Turkey myrrh) are met with in irregular red-brown pieces which deepen in colour when breathed on. They are brittle and easily powdered, and their fracture is shining, irregular, and occasionally dotted with opaque white markings. Myrrh has an acrid bitter taste, and an agreeable aromatic odour. When heated it softens, froths up, and after a while takes fire, but burns with difficulty. It is nearly insoluble in water, but readily dissolves in rectified spirit. It consists of 63·7 per cent. of gum ; 27·8 of resin ; and 2·6 of volatile oil ; the two latter being its active ingredients. (Christison).

Impurities.—Inferior varieties of myrrh are often mixed with those of better quality. They are coarse, opaque, hard, resinous, very dark coloured, and devoid, or nearly so, of the pure aromatic odour and peculiar balsamic taste of the superior varieties. Straw, sand, and other mechanical impurities are also sometimes present.

Actions and Uses.—Myrrh is a stimulating tonic ; and seems to act chiefly on the digestive organs, improving the appetite and promoting assimilation. According to some it also stimulates the uterus, and arrests excessive mucous secretions, bearing in this respect some resemblance to copaiva. It is allied to the turpentines and balsams, but differs from them in possessing tonic properties; and from the fœtid gum resins in being devoid of antispasmodic action. It is prescribed in indigestion depending on weakness, and also in chronic catarrh and other mucous discharges; but for all internal purposes it may be readily dispensed with. Its principal employment in veterinary practice is as a stimulant for indolent sores and ulcerations; and for such purposes it may be used in the form of powder, tincture, or compound tincture.

Doses, etc.—The dose for horses or cattle is ʒij., and for dogs grs. xv. to grs. xx. These doses are given repeatedly, either alone, with other tonics, or with aloes, as in the form of the compound tincture of aloes and myrrh. The simple tincture of the Pharmacopœias may also be sometimes serviceable. It is thus prepared:—

"Take of myrrh, in moderately fine powder, three ounces and a half; rectified spirit, two pints; pack the myrrh very gently without any spirit in a percolator; then pour on the spirit; and when thirty-three fluid ounces have passed through, agitate well to dissolve the oleo-resinous matter which first passes, and which lies at the bottom. This tincture is much less conveniently obtained by the process of digestion for seven days."—(Ed. Phar).

NAPHTHA.

Tennant's Anæsthetic Spirit.

A purified naphtha, made from the ammoniacal liquor of the gas-works, has of late been manufactured by the proprietors of the St. Rollox Works, Glasgow, under the name of Tennant's anæsthetic fluid. It is a mobile, colourless, inflammable, liquid carbo-hydrogen, with a strong diffusible and disagreeably naphthous flavour. It has been chiefly used as an anæsthetic, and operates on horses and dogs almost as speedily and effectually as chloroform. Its effects, however, are usually accompanied by tremors of the muscles, and succeeded by considerable nausea and depression. Were it not for its disagreeable flavour, it might, from its activity as a solvent, be used as a cheap substitute for alcohol.

NITRIC ACID.

Aquafortis. Acidum Nitricum. NO^5.

Anhydrous nitric acid (NO^5) is a white crystalline deliquescent solid which is only met with as a chemical curiosity. The strongest acid of the shops contains 80 per cent. of this anhydrous acid, has the density of 1500, and is prepared by distilling together equal weights of sulphuric acid and nitrate of potash or of soda. But the strength and causticity of this acid are so inconvenient that a diluted variety, having the density 1390 is generally preferred.

Properties.—Nitric acid is colourless, or nearly so, has a pungent, suffocating odour, and an acid acrid taste, corrodes and dissolves many organic substances, and when dropped on the skin produces a yellow stain, which is deepened in colour by the application of alkalies, and removed only by the wearing down of the part. Strong nitric acid has a great affinity for water; if kept in imperfectly stoppered vessels, it soon increases in quantity and diminishes in strength; and when diluted with water evolves much heat. When exposed to light it gradually acquires a yellow colour from small quantities of it being decomposed into oxygen, which is given off, and ruddy brown nitrous acid (NO^4), which remains dissolved in the liquid, imparting to it a red-brown colour. This solution constitutes the *nitrous acid* of the shops, is even more corrosive than pure nitric acid, and if dropped on the fingers, causes effervescence. Nitric acid is readily deoxodised, especially by metals; and combines with bases, forming nitrates, which are soluble salts, undergoing decomposition at a red heat, and deflagrating when thrown on burning fuel. A mixture of one measure of nitric acid, and two of hydrochloric, forms *aqua regia*, which is used as a solvent for gold, and is distinguished by its orange-brown colour, and odour of chlorine. There are many characteristic tests for nitric acid: it produces, with morphia, an orange-brown solution; it becomes deoxodised by zinc and some other metals with evolution of ruddy nitrous acid fumes; gives a yellow stain (of xanthoproteic acid) to wool, cotton, and other organic substances; bleaches a warm solution of sulphate of indigo; and produces, with a solution of proto-sulphate of iron, an olive-green coloured ring where the two liquids meet.

Impurities.—The density and colour of nitric acid are the simplest and best tests of its purity. Its density indicates the proportion of water it contains, and its colour the presence of nitrous acid. Any trace of sulphuric acid is precipitated from a diluted solution by chloride of barium; while the presence of hydrochloric acid is readily indicated by nitrate of silver.

Actions and Uses.—The actions and uses of nitric acid are the same as those of the other mineral acids. According to its quantity and degree of concentration, it is irritant, caustic, astringent, or tonic; and is also used as an antiseptic and disinfectant. In excessive doses, it causes extensive gastro-enteritis, disorganisation of the mucous membrane, and fatal exhaustion, with the same symptoms and post-mortem appearances as occur in poisoning by sulphuric acid. When a strong solution has been given, yellow marks may usually be perceived about the mouth and fauces. In the stomach and intestines, however, this discolouration is seldom observable, owing to the inflammation and extravasation of blood. In men and dogs it sometimes causes chronic inflammation of the alimentary mucous membrane, with consequent arrestment of assimilation, and death after some weeks. As with other irritant poisons, it is less active and fatal in cattle than in horses and dogs, owing to the stomachs of ruminants being constantly filled with food, and the alimentary mucous membrane being unusually thick and non-vascular. When injected into the veins, it coagulates the blood, and causes death in a few minutes. In all animals its appropriate antidotes are diluted alkalies, soap, chalk, and magnesia.

It is seldom used internally. It might, however, like sulphuric acid, be given as a stomachic and tonic during convalescence from debilitating disorders, in inveterate skin complaints, and in chronic enlargement of the liver in cattle. Among the lower animals, it is not used as a diuretic. It is a useful caustic for extirpating warts and fungous growths; for removing the hardened scurf which often accumulates in old cases of scab and mange; and for improving the condition and destroying the fœtor of unhealthy wounds, and cases of caries, foul, and foot-rot. Its causticity chiefly depends on its affinity for water, and its readily parting with oxygen.

It is very effectual in destroying animal and vegetable effluviæ; but its deodorising and disinfectant properties cannot be extensively applied, owing to its expense, and its corroding action on all organic and metallic substances.

Doses, etc.—The dose of nitric acid for horses or cattle, is ʒi. or ʒij., and for dogs, from gutt. ij. to gutt. iv. It should be given largely diluted. A diluted solution is also the common form for external application, but an ointment is sometimes used, and may be made in the following manner :—

"Take a pound of olive oil, four ounces of axunge, and five drachms and a half, by measure, of nitric acid. Melt the axunge and oil together in a glass vessel; when the mixture is nearly concrete, add the acid, and stir briskly with a glass rod till the whole solidifies."—(Dub. Phar.)

NUX VOMICA.

Seeds of *Strychnos Nux Vomica.*

Nat. Ord.—Strychneæ. *Sex. Syst.*—Pentandria Monogynia.

The *Strychnos nux vomica* abounds on the southern coasts of India, and in many islands of the Indian Archipelago. It is a moderate sized tree, with a crooked stem, irregular branches, a tough, white wood, known in commerce as *snake wood;* a white or yellow bark—the *false Augustura bark* of the shops; oval shaped, shining leaves, of variable size; round berries, about the size of apples, and containing, amid a soft gelatinous pulp, several round, flat, greyish-brown seeds, about an inch in diameter, and covered with short brown hairs. These seeds (*nuces vomicæ*) have a little umbilicus on their ventral surface, and are so tough and horny that, in order to powder them, they require to be steamed, sliced, and ground in a coffee mill. The powder has a slightly sweet odour, and an intensely bitter, acrid taste; dissolves in water and alcohol; and is easily distinguished by its dirty greenish-grey colour, its intensely pure bitter taste, and its producing an orange-red tint when moistened with nitric acid. In solution, it is coloured orange-yellow by nitric acid, and green by perchloride of iron. Nux vomica contains gum, starch, lignine, wax, concrete oil, yellow colouring matter, a peculiar soluble crystallizable acid called *strychnic* or *igasuric acid*, and two poisonous alkaloids—*strychnia* and *brucia*. These are present in all parts of the tree, but especially in the seeds and bark. Their properties and uses will be noticed below.

Actions and Uses.—Nux vomica, in large doses, is a deadly poison, and in medicinal doses is occasionally used as a tonic.

It acts as a powerful stimulant on the spinal chord, especially on its motor tract. It does not affect those parts of the brain connected with thought or special sense; nor has it any direct effect on the action of the heart. It acts on all animals as a deadly poison. Half a drachm of powdered nux vomica killed a moderate sized dog in forty-five minutes. Eight grains are also said to have proved fatal to dogs, five grains to cats (Christison), and one or two ounces to horses (Moiroud). Hertwig observed that doses of ten drachms were inadequate to destroy a horse, when given in the solid state, but proved fatal in ten hours when given in solution. He gave a goat 440 grains in eleven days, without observing any obvious effect. Poisonous doses produce in all animals trembling, twitching of the voluntary muscles, and violent tetanic spasms, which gradually become more frequent and severe, and from their involving the diaphragm and muscles of respiration, cause death usually by asphyxia, occasionally by exhausting the irritability of the heart. The symptoms and mode of death are much the same as in tetanus, from which, however, this variety of poisoning may be readily distinguished by the sudden development of the symptoms, their intermittance, and their rapidly fatal termination. The most uniform post-mortem appearances are general venous congestion; engorgement of the lungs, membranes of the brain, and spinal cord; softening of the cerebellum and spinal cord; flaccidity and emptiness of the heart; and when the patient has survived for some time, redness and inflammation of the intestines. The muscles are sometimes hard and rigid as before death, but sometimes soft and flaccid. There are no antidotes for poisoning by nux vomica. The removal of the unabsorbed poison by the use of emetics or the stomach-pump, is often effectual in saving a patient; but when the poison has been absorbed, and its physiological action developed, there is little hope of recovery. Tinctures of iodine and of galls are of no service unless given immediately after the poison.

Nux vomica has hitherto been little used in veterinary practice, but might probably be useful in certain cases of chronic paralysis. French veterinarians have sometimes given it with good effect in amaurosis and stringhalt in horses, and chorea amongst dogs, especially when accompanied by debility. To use it with advantage it must be persevered with until it produce some of its earlier physiological effects, as twitching of the extremities or of the affected part—symptoms which are usually first apparent during the night, and when the paralysed part is suddenly touched or struck. If therapeutic effects do not shortly succeed the production of these physiological effects, the medicine will be of little service how long soever it be given, and need not, therefore, be longer continued. It is not, as some have thought, a cumulative medicine, nor, on the other hand, is the susceptibility of the system to its action diminished by use, as is the case with opium and tobacco. It must be avoided in spasmodic diseases, and also in all nervous affections, so long as they are accompanied by inflammatory symptoms.

Doses, etc.—The dose of powdered nux vomica is about ʒi. for horses and cattle; and grs. ij. for dogs. These doses should be repeated daily, and slightly and gradually increased until some of their physiological or therapeutical effects are produced. The powder is conveniently given in the state of a bolus. The extract, much used in human medicine, is got by percolating or boiling the powder with rectified spirit, recovering most of the spirit by distillation, and evaporating the residue in a vapour bath. It is six or eight times as active as the simple powder. Tinctures of nux vomica are occasionally used, but are inconvenient, as they do not cover the bitter taste of the drug.

Strychnia or Strychnine.

Strychnia, besides being found in the *Strychnos nux vomica*, is also present, in many other plants of the same natural family, and is believed to enter into the composition of the famous Wourali poison. At present it is only prepared from nux vomica, but Professor Christison considers that it might be as cheaply and easily procured from the false angustura bark. The Edinburgh College gives the following directions for the preparation and purification of strychnia :—

"Take of nux vomica, one pound; quick lime, one ounce and a half; rectified spirit, a sufficiency; subject the nux vomica for two hours to the vapour of steam, chop or slice it, dry it thoroughly in the vapour bath or hot-air press, and grind it in a coffee-mill. Macerate it for twelve hours in two pints of water, and boil it; strain through linen or calico, and squeeze the residuum; repeat the maceration and decoction twice with a pint and a half of water. Concentrate the decoctions to the consistence of thin syrup; add the lime in the form of milk of lime; dry the precipitate in the vapour bath, pulverise it, and boil it with successive portions of rectified spirit till the spirit cease to acquire a bitter taste. Distil off the spirit till the residuum be sufficiently concentrated to crystallize on cooling. Purify the crystals by repeated crystallizations."—Edin. Phar.

The important steps in this as in most other processes for obtaining strychnia, are reducing the nux vomica to powder, forming a watery solution containing the alkaloid as the igasurate of strychnia, decomposing that salt by caustic lime (or magnesia), dissolving out the precipitated strychnia by alcohol, and purifying the impure crystals. The proportion of impure or crude strychnia got from nux vomica does not exceed one 200th part. That sold in the shops as strychnia is in reality a mixture of the two alkaloids of the nux vomica, and farther contains a variable proportion of colouring matter. The two alkaloids may easily be separated by making a solution of commercial strychnia in nitric acid, from which the nitrate of strychnia may be readily crystallized leaving the nitrate of brucia in solution.

Both alkaloids are colourless when pure, are crystalline, alkaline, intensely bitter, combustible, almost insoluble in water, but readily soluble in hot alcohol and volatile oils. Brucia is less bitter and insoluble than strychnia, and is reddened by nitric acid, which turns pure strychnia yellow.

Actions and Uses.—Strychnia is one of the most active of poisons. One-sixth part of a grain, given in solution, destroys a dog in two minutes, and sometimes even in shorter time; and one-eighth of a grain in twelve minutes; while half a grain introduced into a wound would be sufficient, it is believed, to kill a man within a quarter of an hour. Its effects occur by whatever channel it is introduced into the body, and with a celerity varying with the rapidity of its absorption. Like nux vomica it chiefly affects the spinal cord and motor nerves; but has no direct effect on the brain proper or on the circulation. In dogs the symptoms produced are uneasiness, nausea, and sometimes vomiting, trembling, and stiffness of the extremities, general spasm, during which the head is drawn upwards and backwards, tetanic convulsions, which intermit occasionally, but recur again and again with increased force until death is produced from the muscles of respiration becoming fixed and immoveable. There is no narcotic effect, but, on the contrary, unusual acuteness both of common and special sense. In horses and cattle similar effects are produced, but only when the doses are both absolutely and relatively larger than those for the dog. On Monday, 18th October 1852, at twelve o'clock, I gave a small brown cow, affected by pleuro-pneumonia, and in a state of great weakness, grs. xv. of strychnia, suspended in f℥ij. of oil. At 12.30 the pulse had risen from 70 to 78, regurgitation was observable in the jugular veins, and quivering and twitching of the facial muscles, particularly during inspiration. At 12.45 the pulse numbered 84, and all the symptoms were aggravated. Two grains of strychnia were given, dissolved in diluted acetic acid, and in a quarter of an hour after the animal was very uneasy, and attempted to vomit, the pulse was 94, full and strong, and the pupils much dilated.

At 1.30 the nausea and efforts to vomit were much increased, and the breathing more laboured. The animal lay down, and the pulse shortly fell to 58. At 2.15 the nausea was diminished, and the pulse was at 92. Thirty grains of strychnia were then given in acetic acid and water. At 2.20 the pulse was 100, sharp and distinct. The muscles were affected by frequent spasms. At 2.25 the pulse was 140, and the animal showed much sensitiveness, especially about the hinder extremities. It reeled and fell. At 2.30 the pulse had risen to 160, the limbs were very rigid, the eyes protruding, and the involuntary spasms more general, frequent, and severe. In two minutes after she died quietly. The post-mortem appearances were similar to those above mentioned as occurring in poisoning by nux vomica. In two dogs, lately destroyed at the Veterinary College with one-eighth of a grain of strychnia, the buccal mucous membrane was blanched, the left auricle, as also the intestines, continued to contract for nearly an hour after death, and the cerebral and intestinal vessels were congested with dark venous blood.

The uses of strychnia are the same as those of nux vomica. An interesting case, illustrative both of its poisonous and medicinal action, has come under my observation while these sheets are passing through the press. A four year-old horse, that had suffered from a severe attack of staggers, lost the power of moving his hinder extremities. He could not be moved, turned, or put backwards, without imminent risk of falling. Mineral tonics were given for a fortnight, without any obvious amendment. Four grains of strychnia, made into a bolus, were then administered morning and evening. Gradual improvement ensued. The doses were slowly augmented until they amounted to ten grains, which were given daily in two separate doses. No physiological action was observable; no twitching or unusual sensitiveness of the muscles; no acceleration or alteration of the pulse. But the appetite improved, the muscles became firmer; and in about three weeks from the first use of the strychnia, the patient was able to walk without reeling, and could also turn and back without any difficulty. The strychnia was withheld for four days, and the patient became decidedly worse, and walked very unsteadily. The medicine was again prescribed, but, from an unfortunate mistake, was given in doses of five grains, repeated twice a day. After three such doses had been administered, violent spasms supervened, affecting especially the head and neck, and becoming particularly severe when the animal was touched or disturbed. Clysters and stimulants were employed, and after two days the poisoning effects of the alkaloid had disappeared. The paralysis, however, still remained, and was accompanied by hanging of the head and stupor. Blisters were applied along the spine, and the use of the strychnia renewed, in doses of two and a half grains given twice a day. Under this treatment, the paralytic symptoms again diminished, and in fifteen days (when this sheet went to press), the patient was able to walk and turn with comparative ease, and appeared in the fair way of recovering. It will be observed that, in this case of paralysis, the use of strychnia caused speedy amendment; its cessation was followed by relapse; its subsequent exhibition, in doses of five grains, induced, after three doses given at intervals of twelve hours, acute poisoning, with aggravation of the paralysis; while, lastly, its employment in lesser doses led to the restoration of health. Strychnia has also been recommended in amaurosis, and other forms of partial paralysis, and is said to have been serviceable when used endermically.

Doses, etc.—The dose for the horse is about grs. ij., and for the dog about gr. 1-15th. It is generally given twice a day, in the morning and evening, and continued in gradually increasing doses until it produces some physiological or curative effects. From its subtlety as a poison, and its irregularity of strength, it must be used with much caution. On account of its intensely bitter taste, it is best given in the form of a bolus, but may, if preferred, be dissolved in water, acidulated with sulphuric or acetic acid.

Brucia differs from strychnia only in the degree of its action, some considering that it has one-sixth, others one-twelfth, and others one-twenty-fourth of the activity of strychnia.

OAK BARK.

Quercus cortex. Bark of *Quercus robur* or *pedunculata.*

Nat. Ord.—Amentaceæ (De Can). *Sex. Syst.*—Monœcia Polyandria.

Oak bark is met with in pieces of various size and thickness; is fibrous and brittle; and, when dry, of a brown, wrinkled appearance externally, and a smoother redder appearance within. It has a powerful astringent taste, which is readily communicated to water. The infusion reddens litmus, gives a dark, bluish-black precipitate with sesquisalts of iron, and a white flocculent precipitate with solution of gelatine. The astringency and chemical reaction of oak bark depend on the presence of from 12 to 16 per cent. of tannin. The largest per centage of this principle is got during spring, in the white internal part of the bark of the young branches.

Actions and Uses.—Oak bark is an astringent and tonic. In omnivora and carnivora, it has a decided astringent effect on all the secreting surfaces, but in vegetable-feeding animals it is more slowly digested and absorbed, and scarcely exerts more than a topical action. It is employed, in all animals, for arresting chronic diarrhœa, dysentery, and similar mucous discharges. As a tonic it is inferior to cinchona, and probably to gentian; and is apt, when given repeatedly, to cause intestinal derangement. It is much used for stimulating unhealthy ulcerations, and arresting gangrene. It is also serviceable in reducing herniæ, and protusions of the anus and uterus, and in such cases is best used dissolved in a large quantity of water, and mixed with a little laudanum. It is a useful styptic, and an excellent gargle for relaxed sore throats in man.

Doses, etc.—The dose for horses and cattle varies from ℥i. to ℥iv., and for sheep and dogs from ʒiv. to ʒviij. It is generally administered in the fluid state. In many cases it is given with aromatics and bitters; in dysentery, with opium and starch gruel; and, in typhoid fevers, with camphor and mineral acids. As an external application, it is used both in powder and solution, alone and in combination.

OLIVE OIL.

Olivæ Oleum. Expressed oil of the pericarp of *Elea Europea*. —(Ed. Phar.)

Nat. Ord.—Oleaceæ. *Sex. Syst.*—Diandria Monogynia.

Olives are obtained from several different varieties of an evergreen tree, which grows abundantly in most of the southern parts of Europe. The olive is a succulent fruit, about the size of a damson, and containing a single seed. The oil is chiefly yielded by the fleshy pericarp, but also in small quantity by the seed or kernel. The finest quality of oil is generally imported from Provence or Florence, and is got by expression alone. That of medium quality is brought in large quantity from Naples, and is prepared by steeping the olives in water previous to expression; while a still inferior variety, which is often fermented, comes from Sicily and Spain, and is obtained by moistening and pressing the residue left during the manufacture of the superior qualities.

Properties.—Olive oil belongs to that class of oils known as the fixed, fatty, or expressed oils. They produce, on paper or linen, a greasy stain, which is not removed by heat; they do not dry up or form varnishes; they congeal at low temperatures, boil about 600°, and at higher temperatures are decomposed with evolution of carbonic acid, carbonic oxide, and carburetted hydrogen. Olive oil is a transparent, unctuous, odourless, bland-tasted fluid, of the consistence of syrup. When pure it is pale greenish-yellow; when impure, yellow or brown. Its specific gravity, at 77°, is about 911. At 38° much of the margarine it contains separates in crystalline grains. It is not miscible with water, is scarcely soluble in alcohol, but dissolves in twice its weight of ether. When exposed to the air it absorbs oxygen, thickens, and slowly becomes rancid, but does not dry up. "When carefully mixed with a twelfth of its volume of nitrate of mercury, prepared as for the unguentum citrinum, it becomes, in three or four hours, like a firm fat, without any separation of liquid oil."—(Ed. Phar.) When olive oil is adulterated with rape or poppy seed oil, or any other of the inferior oils, the fat thus produced is soft, and formed very slowly. Pure olive oil, if shaken in a phial, froths very slightly, and its surface is little broken by air-bells. It contains 28 per cent. of the neutral pearly solid fat, called margarine, dissolved in 72 per cent. of the fluid fatty principle, oleine.

Actions and Uses.—Olive oil, like other oleaginous bodies, is in small quantity, easily digested and assimilated. In larger quantity, it disorders the digestive functions; and in still larger quantity, as in doses of one or two pints for horses or cattle, and two or three ounces for dogs, it has a laxative effect. It is rarely used internally, being inferior to castor or linseed oil as a cathartic, and scarcely superior to the cheaper linseed oil for most emollient and demulcent purposes. Like other fatty matters, it causes death when injected into the veins, probably by obstructing the capillary circulation. Half an ounce injected into the jugular will speedily destroy a medium-sized dog. It is used externally as an emollient, and when of good quality is preferable to most other oils, on account of its not readily drying up or becoming rancid; but its high price stands in the way of its extensive use. It enters into the composition of many ointments and liniments, and is the largest ingredient of the unguentum simplex, which is made by melting together two ounces of white wax, and five fluid ounces and a half of olive oil.—(Ed. Phar.)

OPIUM.

Concrete Juice from the Unripe Capsules of *Papaver somniferum*. —(Ed. Phar).

Nat. Ord.—Papaveraceæ. *Sex. Syst.*—Polyandria Monogynia.

Opium, which is one of the most ancient articles of the materia medica, derives its name from the Greek word ὀπὸς, *opos*, signifying juice. It may be obtained from any of the many species of poppy, several of which abound as annual weeds in most parts of the country. The stem, unripe capsules, and other succulent parts of the poppy contain a milk-white narcotic juice. The roots of many species contain a cathartic principle. The seeds are almost devoid of narcotic properties, but contain a bland, drying oil, similar to linseed or rapeseed-oil. The cake, or residue of the seeds left after the expression of the oil, is now used in considerable quantity as food for cattle.

The true opium poppy is the *Papaver somniferum*—the common white or garden poppy. It is a native of the warmer parts of Asia, is largely cultivated in Asia Minor, but also thrives well in this country. It flowers in June or July, and the capsules ripen about two months after. It is of large size, from two to six feet high, having a round, smooth, erect stem, with a few white hairs on the peduncles or leaf-stalks; large, sessile, glaucous green leaves, with cut and wavy margins; large terminal flowers of a white, red, or purple colour, and drooping before they open; and globose capsules about the size of a duck's egg, and containing numerous kidney-shaped seeds, either of a white or brown colour. All the opium of commerce is derived from the several varieties of this poppy. The white-flowered varieties have hitherto been generally preferred, but the darker-flowered kinds, especially the purple, are now believed to yield a larger quantity and better quality of opium.

The collection of the juice is very simple. At sun-set the collectors make horizontal superficial incisions into the partially ripened capsules, shortly after the falling off of the petals. There exudes from the incisions a thick milk-white juice, which concretes and deepens in colour, until it forms semi-solid, red-brown, adhesive tears. This is opium. In from twelve to twenty-four hours after the incisions have been made, the little tears, weighing a few grains, are collected from each capsule, formed into larger masses, dried, and packed for exportation in poppy leaves, in the leaves and winged seeds of a species of rumex or dock, or in tobacco leaves and poppy petals. In 1851 the opium imported to this country amounted to 106,113 cwts.—(Pharmaceutical Journal, March 1852.)

Varieties.—There are at least five distinct sorts of opium—Turkish, Egyptian, East Indian, Persian, and European; and each of these, from differences in the cultivation of the poppy, or in the extraction and subsequent treatment of the juice, is liable to considerable differences in appearance and quality.

Turkey Opium is met with of several different kinds, most of them of fine quality and highly prized in the English market. It is collected in Anatolia, in Asia Minor, and exported from Smyrna, and in lesser quantity from Constantinople. It is generally covered with impressions of the seed of the rumex, or with poppy leaves; and occurs in roundish flattened pieces weighing from six ounces to three pounds. It is soft, moist, and ductile, of a uniform structure, and when minutely examined seems made up of small lenticular pieces. It has a peculiar but not disagreeable odour, a bitter taste, and when recently fractured a pale liver-brown colour. It readily yields its active principles to water, forming a pale-coloured solution, and to alcohol of all strengths, forming dark-coloured tinctures. It contains more morphia than most of the other varieties. When of inferior quality, it has a dark colour, a resinous structure, and an unequal irregular texture; is often dry and hard from long keeping; forms a dark-coloured infusion; and contains a small proportion of morphia.

Egyptian Opium is a recently introduced variety, and corresponds very nearly with some of the second-rate qualities of Turkey opium. It is of a pale brown colour, hard, dry, brittle, and of a waxy structure. Like most other sorts, it is apt to vary in appearance, and is often made up in imitation of whatever kind happens at the time to be in highest repute.

East Indian Opium is largely prepared in several parts of the East Indies, but chiefly near Benares and Patna, and in the province of Malwa. It is almost all disposed of to the Chinese, who prefer it to Turkey opium, and purchase annually upwards of a thousand tons' weight of it, at the rate of twenty shillings per pound. It is usually inferior to Turkey opium, and contains less morphia, but more narcotine. In preparing it, the juice is extracted from the poppy in the usual way, the fluid part is poured off, and the solid residue carefully dried in the shade, and disposed off by the native cultivator to the opium factories, where it is purified, raised to the desired consistence, and encased in poppy, and sometimes in tobacco leaves. The outer case gradually becomes black, hard, unyielding, and of the appearance of a large bullet; and usually contains about three pounds eight ounces of standard opium, which remains for a long time soft and ductile, and has in most specimens a dark appearance, resembling pitch.

East Indian opium, when not intended for exportation, is dried in the sun until it contains only a small quantity of water or volatile matter (in the Benares Agency not more than 10 per cent. being separable by continued exposure to 200° F.). It is then moulded into square pieces weighing rather more than two pounds each, enveloped in oiled Nepaul paper, and packed in wooden boxes. (Pharmaceutical Journal, vol. xi., p. 360). It is firm, dry, of a yellow-brown colour, and nearly equal to Turkey opium in quality and per-centage of morphia.

Persian Opium is of very low quality, and scarcely saleable in this country. It occurs in little rolls, five or six inches long, about the size of the finger, and enveloped in paper. It has a light brown colour, and continues soft even after being kept for some time. Its designation of Persian opium is probably a misnomer, as it is generally believed to be made in London.

European Opium.—Opium has at various times been prepared in several parts of France and Germany, and its cultivation has also been attempted in Great Britain. In 1818, Dr Young cultivated poppies in the neighbourhood of Edinburgh, and obtained nearly six ounces of excellent opium from a fall of ground, being at the rate of 57½ lbs. per acre. A still more extensive trial was made in Buckinghamshire in 1823, by Messrs Cowley and Staines, who grew upwards of twelve acres of poppies, and got a return of 16 lbs. per acre of very fine opium. Its quality was equal to that of any Turkey opium, and it realised the highest price in the London market. From the high price of Turkey opium at that time, and the low rent of land, the speculation was tolerably lucrative. At present, however, the preparation of opium in this country would not, it is believed, be profitable, unless as large a return of opium could be got as in India, where the average yield per acre is 30 lbs., and, according to some, even more. It is possible, however, that in favourable circumstances poppies might be cultivated here expressly for the preparation of morphia, which could be directly obtained from the juice without first inspissating it.

Properties.—The several kinds of opium, although possessed of various distinctive properties, have also many in common. They are all obtained from the partially ripened capsules of the same species of poppy; and, when of good average quality, have a dark brown colour externally, with a red tint within, a compact, regular structure, often made up of agglutinated tears, a somewhat waxy fracture, a specific gravity of about 3·36, a strong, peculiar aromatic odour, and a disagreeable persistent, bitter taste. When recently imported, they contain from 6 to 17 per cent. of water, and are moist and tough; but when long kept, or artificially dried, they are hard, and easily reduced to a brown powder, which is apt, unless carefully preserved, to absorb moisture. When heated they soften, and at high temperatures burn with a strong, peculiar odour. Water dissolves about two-thirds of a good specimen of opium, and forms a red-brown solution, including most of the active ingredients; rectified spirit dissolves about four-fifths, and forms a dark brown tincture, which includes all the active principles. Acids, when strong, disorganize opium, but when diluted, are excellent solvents for it. Strong alkalies in small quantity decompose it, but in excess dissolve it. Its watery solution reddens litmus, owing to the presence of meconic acid, and is precipitated by vegetable astringents, salts of lime, lead, copper, and many other metals.

Impurities.—As the better qualities of Turkey opium usually bring about 18s. per pound, there is great temptation to substitute inferior qualities of the drug, or to mix it with various foreign matters. Inferior specimens of opium may generally be distinguished by narrowly examining their consistence, texture, colour, odour, and taste. They are often dry, hard, and resinous, or oleaginous and waxy, and their fresh fracture is devoid of that red tint and agreeable aromatic odour which characterize most good specimens of the drug. Water and alcohol dissolve them imperfectly. Many different substances are used for adulterating opium. The most common of these are starch and molasses, the bruised leaves and chips of the poppy, and the juice, pulp, or extract of the prickly pear, the tobacco, or other plants. These additions are generally made before the drug is imported; and their presence may sometimes be ascertained by minute inspection. Inorganic matters, as sand, clay, and mud, may be detected in the same manner, especially if the specimen be first dried. Excess of moisture is easily discovered by drying a weighed quantity in a water bath, and ascertaining the loss which should not, even in recent specimens, exceed 17 per cent. By far the best and most certain test of the quality or purity of any specimen of opium is the proportion of morphia which it contains. When subjected to Dr Gregory's process, good opium should yield 10 per cent. of muriate of morphia. The following test of the Edin. Phar., though not so accurate, is more easy of application.

"A solution from 100 grains of fine opium macerated twenty-four hours in two fluid ounces of water, filtered, and strongly squeezed in a cloth, if treated with a cold solution of half an ounce of carbonate of soda in two waters, yields a precipitate, which weighs when dry at least ten grains, and dissolves entirely in solution of oxalic acid.—(Ed. Phar.)

Pereira, in the last edition of his "Elements of Materia Medica" (vol. ii. part ii. p. 2107), gives the following characters as distinctive of good opium. When treated with cold water it should be completely divided, the extractive matter becoming dissolved. The solution, although at first turbid, should speedily become clear, should gradually assume a brown colour, and, when boiled with chloride of calcium, should yield a white precipitate of meconate and sulphate of lime.

Composition.—Opium is a very complex substance, and the many published analyses of it differ much from each other. It contains at least seven crystalline principles which are retained in solution by sulphuric and meconic acids. Some of these, and of the other more important constituents are stated in the subjoined analysis made in 1831 by Biltz, and copied from Christison's Dispensatory :—

	Turkey Opium.
Morphia, not quite pure,	9·25
Narcotine,	7·50
Meconic acid, impure,	13·75
Bitter extractive,	6·50
Extractive, slightly bitter,	15·50
Deposit,	7·75
Albumen and Gluten,	20·00
Balsamic oil,	6·25
Gum and a little lime,	1·25
Caoutchouc,	2·00
Sulphate of potash,	2·00
Lime, iron, alumina, and phosphoric acid,	1·50
Lignine and impurities,	3·75
Ammonia, volatile oil, and loss,	3·00
	100·00

In the following paragraphs I shall briefly notice the more important of the various constituents of opium, especially those of a crystalline nature.

Morphia or *Morphine* is the most important of the crystalline principles of opium, and is best prepared by decomposing with ammonia a solution of muriate of morphia prepared by Dr William Gregory's process (p. 323), washing the precipitate and drying it at a gentle heat. The yield from different specimens of opium varies from 4 to 9 per cent. It is a snow-white, hard, crystalline powder, with an intensely bitter taste, and an alkaline reaction. It usually occurs in six-sided needle-like crystals, which are commonly arranged in little tufts. It dissolves sparingly in water or ether, but readily in alcohol, potash, and weak acids, with which it forms crystallizable and usually soluble salts. With sesqui-chloride of iron it produces a purple-blue solution, which gradually becomes green; with nitric acid an orange-yellow precipitate or solution; and with iodic acid a red-brown liquid containing free iodine. Its composition, according to Regnault, is $C^{35}H^{20}N\ O^{6}$. Its actions and uses are identical with those of its salts. (See p. 324.)

Codeia or *Codeine* is a white, bitter, crystallizable alkaloid, soluble in water, ether, and alcohol, insoluble in caustic potash, and unaffected by sesqui-chloride of iron. It exists in opium in the proportion of about a half per cent.; and may be prepared by evaporating to dryness the mother liquid, which remains after the precipitation of morphia from its hydrochlorate, dissolving out all traces of morphia by potash, and then purifying the codeine by solution in ether or water. It is represented by the formula $C^{36}\ H^{21}\ N\ O^{6}$, and resembles morphia in its physiological effects, but has only a fourth of its activity.

Narcotine exists in opium in quantities varying from one to eight per cent., and generally in inverse proportion to the amount of morphia. It may be got by treating the insoluble residue left in the preparation of morphia with diluted acetic acid, precipitating the solution with ammonia, and purifying the impure narcotine with hot alcohol and animal charcoal. It occurs in pearly tabular crystals, which have an insipid taste, and are soluble in alcohol, ether, and weak acids, but not in water or caustic potash. It is a feeble base, and forms bitter salts, which crystallize with difficulty. It is distinguished from morphia by the non-effect of nitric acid and sesqui-chloride of iron. It consists of $C^{46} H^{25} N O^{14}$. It is probably devoid of all narcotic action, but is antiperiodic, and has been advantageously used in India as a substitute for quinine in the treatment of intermittent and remittent fevers. It was at one time erroneously considered to be the cause of the peculiar and unpleasant effects which some persons experience in using opium.

Narceine is a feeble base present in opium, in quantities of from six to thirteen per cent. When pure it forms silky needle-like crystals which are neutral, sparingly soluble in water, readily soluble in alcohol, and produce a blue colour with hydrochloric acid. It consists, according to Dr Anderson, of $C^{46} H^{29} N O^{18}$. It is believed to be inert.

Thebaine or *paramorphia* is a white crystalline substance, with an acrid taste and an alkaline reaction. It is almost insoluble in water, but is soluble in alcohol and ether. Its formula is $C^{38} H^{2} N O^{6}$. It has no narcotic effect; but is said by Magendie to act like strychnine, a single grain injected into the jugular vein or pleura of a dog, producing violent tetanic spasms and death in a few seconds.

Papaverine, another crystalline base, has recently been found in opium. It is as yet little known, but appears analogous to thebaine, and has the composition $C^{40} H^{2} N O^{8}$.

Porphyroxine is a neutral crystalline principle, forming, when heated with acids, a red or purple solution. Its action is not well known.

Meconine is a white, fusible, volatile, crystalline, neutral principle, soluble in water, alcohol, and ether, and with an acrid but not bitter taste. It has the formula $C^{10} H^{5} O^{4}$; and is probably quite inert.

Meconic Acid is a crystalline substance found only in opium, and forming, along with a small quantity of sulphuric acid, the solvent for the basic crystalline principles already noticed. It is present in Turkey opium in quantities varying from four to seven per cent. (Mülder); and may be obtained as a by-product in the preparation of muriate of morphia, by mixing the crude meconate of lime (see process for muriate of morphia, p. 323) with twenty parts of boiling water and three parts of strong hydrochloric acid. The purifying of the meconic acid from sulphate of lime and colouring matter, is troublesome and tedious. The acid, when pure, is in brilliant, snow-white, scaly crystals, which are soluble in water and alcohol. Its watery solution, when heated above 150°, is decomposed, and becomes of a dark-brown colour. It forms, with sesqui-chloride of iron, a blood-red solution; and with ammonio-sulphate of copper a green precipitate. It is a tribasic acid, with the composition $C^{14}H O^{11} + 3 HO$, and is believed to be nearly inert.

Besides these crystalline constituents, opium contains a brown resinous substance, which, when exposed to the air or to heat, combines with the alkaloids forming insoluble compounds—a brown extractive matter, which has been supposed to impart some narcotic property to the drug—an oily or fatty substance, —and a volatile odorous principle not yet isolated, but the chief cause of the characteristic aroma of opium. The more important of the other constituents are mentioned in the analysis above given.

Chemical Tests.—Having briefly referred to the different constituents of opium, it will now be necessary shortly to notice the methods of recognizing it, whether in mass or in simple or complex solutions. Solid opium is easily identified by its red-brown colour, peculiar odour, and bitter taste; and a simple solution by the last two of these tests, and by the reaction of nitric acid on the morphia, or of sesqui-chloride of iron on the meconic acid. Opium, however, cannot be detected in the contents of the stomach or other complex solutions, until these be freed of their colouring matters and impurities. This may be effected in several different ways, but the following process will be found simple and effectual:—Reduce the solid parts of the mixture to a state of fine division, add water if necessary, acidulate with acetic acid, filter and evaporate to the consistency of a syrup. Redissolve this in alcohol, boil, and filter when cool. Then evaporate the solution, dissolve the semi-solid residue in water, and filter again. The fluid, which should now be tolerably clear, and contain (if opium has been present) the meconate of morphia, is treated with excess of acetate of lead and filtered. The clear solution so got contains acetate of morphia; the solid residue left on the filter is meconate of lead; and both the solution and the residue afford valuable indications of the presence of opium.

The clear solution is treated with sulphuretted hydrogen to remove any traces of lead, is filtered and treated with carbonate of soda to precipitate the morphia, which is washed, purified if necessary by solution in alcohol, and crystallized in colourless, flattened, hexagonal prisms. Nitric acid dissolves these crystals with effervescence, instantly producing an orange-red colour, which becomes yellow when excess of acid is used. This is a very delicate test, but is not alone certain evidence of the presence of morphia, as nitric acid produces the same effect on brucia and commercial strychnia (alkaloids of nux vomica). The action of perchloride of iron, though scarcely so delicate, is very characteristic. When a drop or two is added to water, containing morphia suspended in it in a state of fine division, it dissolves the alkaloid, forming a deep blue solution. A third test for morphia is the brown colour it produces in a solution of iodic acid. But this test cannot be much depended on, for iodic acid is similarly affected by many other substances besides morphia and its salts.

The solid residue left on the filter, and containing, as above stated, meconate of lead, should also be examined, as the tests for meconic acid are very delicate, and afford indications of the presence of opium, even when it is in such minute quantities as to be undetectable by testing for morphia. The meconic acid may be separated from the lead either by sulphuretted hydrogen or sulphuric acid, both of which combine with the metal forming insoluble salts, which are subsequently got rid of by filtration, leaving the meconic acid in solution. There are several ways in which it may be identified. (*a*). If in considerable quantity it may be purified, and then appears, in fine, thin, delicate tabular crystals, which, when aggregated, have an appearance like spermaceti. (*b*). It may be heated in a tube when it is partly decomposed, partly sublimed, forming radiated tufts of needle-like crystals. (*c*). In solution, it produces, with sulphate of copper, a pale green precipitate, which is dissolved by boiling, but reappears on cooling. (*d*). But its most delicate and characteristic test is the production, with perchloride of iron, of an intense blood-red solution of meconate of iron. For all practical purposes, this test, along with the reaction of nitric acid upon morphia, is conclusive evidence of the presence of opium. It may, however, be remembered that perchloride of iron produces a blood-red solution with acetates, but only in strong solutions, and when the acetic acid can be easily detected by other tests; and with sylpho-cyanic acid, which is a very rare body, existing, it is said, in the saliva of sheep. There are, however, two simple tests, which remove this source of fallacy, and readily distinguish the sulpho-cyanide from the meconate of iron. Corrosive sublimate bleaches the sylpho-cyanide, but does not affect the colour of the meconate. When a portion of each is placed in a separate test-tube, and treated with a few drops of sulphuric acid, and a bit of zinc, sulphuretted hydrogen is given off from the former, but not from the latter of the two solutions. The evolution of the gas is easily detected by its blackening a bit of paper, dipped in a solution, either of acetate of lead, or of nitrate of silver.

Actions and Uses.—Possessed of many different physiological actions, opium is applied for the alleviation and cure of many diseases. It is narcotic, sedative and anodyne, stimulant, antispasmodic, diaphoretic, febrifuge, and an inspissant of mucous discharges.

Like many other medicines and poisons, it has a primary stimulant, and secondary depressant action, as is well illustrated in its topical effect on the skin and mucous surfaces. Its absorption precedes the development of its constitutional effects. It is capable of being taken up from any of the mucous or serous surfaces, from the skin, or from wounds. After entering the blood, it appears to act chiefly on the nerves and nervous centres, first increasing, and then diminishing their action. It usually develops in the lower animals a greater degree of preliminary excitement than in man, and acts more on the posterior parts of the spinal column than on the brain proper, as is well established by its action in poisonous doses. These produce in the lower animals febrile symptoms, imperfect power of motion, convulsions, and death, usually resulting from apnœa or syncope; whilst in man they cause scarcely any exaltation of nervous force, but vertigo, imperfect perception, deadly stupor, and death usually from coma. While opium circulates in the blood, it also appears immediately and directly to relax muscular fibre, especially that of the involuntary muscles, which is probably the physiological origin of its actions, as a diaphoretic, antispasmodic, and astringent or inspissant.

Horses and cattle are less susceptible to the action of opium than dogs and men, and resist especially its soporific tendency. Hertwig mentions that doses of from two to four drachms, when given to horses, have scarcely any other effect than that of a slight stimulant; and that an ounce given in solution caused first increased liveliness, and, after two hours, dulness, diminished sensibility, slower circulation, less frequent evacuations, and stupor,—symptoms which continued for twelve hours, but entirely disappeared by the following day. Two ounces and a half induced similar effects, with convulsions and death in about twenty hours. On 15th November 1852 I gave a strong healthy horse one ounce of powdered opium dissolved in water, and observed that the pulse became small and weak, and in eight minutes fell from forty-four to thirty-four beats per minute; that the superficial fleshy muscles were relaxed, the nasal mucous membrane blanched, and the animal dull and dejected. From disease of the eyes the condition of the pupil could not be noted. After half an hour, four drachms, also dissolved in water, were given, and increased the dulness, the hanging of the head, and weakness of the pulse, which now numbered thirty-two. In half an hour more the animal, continuing in the same state, was destroyed by cutting the carotid artery. In another experiment made about the same time on a mare, which, however, was aged and rather feeble, doses of one drachm given in solution thrice a day caused dulness, loss of appetite, constipation, diminished force of the pulse, and death on the fourth day, and after the exhibition of nine doses. One drachm given thrice a day to a healthy donkey induced, after six doses, acceleration of the pulse to eighty-eight, feverishness, vertigo, nausea, champing of the teeth, and death on the third day of the experiment.

Opium acts even less powerfully on ruminants than on such animals as the horse. Cows take an ounce, and sheep four drachms, without suffering any further bad effects than dryness of the mouth, occasional nausea, and slight depression of the pulse. Swine, after receiving one or two drachms, become first lively, and then dull and sleepy, their bowels constipated, and their skins hot. From one to three drachms given to dogs usually cause, within a few minutes, increased force and frequency of the circulation. Shortly, however, the pulse becomes small and weak, and there is nausea, a staggering, unsteady gait, dilated pupils, twitching of the limbs, convulsions, stertorous breathing, and, as death approaches, a tendency to coma, which is never, however, so deep or lasting as in the human subject, and from which the animal may always be easily roused. The continuance of these symptoms varies from three to fifteen hours; and most animals which survive the latter period eventually recover.

On opening the bodies of animals poisoned by large doses of opium, the brain and lungs are found gorged with dark-coloured fluid blood, which does not, however, yield on analysis any indication of the presence of opium. The stomach and intestines are occasionally slightly reddened. The body passes very rapidly into a state of putrefaction.

In cases of poisoning by opium, which, however, are much rarer among the lower animals than in man, it is essential, in the first place, to get rid of all the poison that may be still unabsorbed, by the prompt employment either of the stomach-pump or of emetics, the latter of which are most effectual both in men and dogs. Any tendency to coma should be prevented by moving the animal about. Blood may also be drawn from the jugular vein to relieve congestion of the lungs, which sometimes proves speedily fatal. In man, the dashing of cold water over the head and chest, artificial respiration, and galvanism, have sometimes saved life even in very desperate cases. Various chemical antidotes have been proposed, but none have stood the test of experience. Even tincture of galls, which is undoubtedly the best, is of little avail unless the stomach be evacuated, and the antidote given early.

Opium is prescribed in more diseases than any other article of the materia medica. It is often serviceable in bronchitis, pneumonia, and pleurisy, whether in horses, cattle, or dogs ; and is commonly given in combination with calomel, and after the more acute symptoms have been somewhat subdued. The doses usually administered are one drachm of opium, and one scruple of calomel, for horses and cattle ; and about ten grains of opium and three grains of calomel for dogs. Such doses when repeated every two hours, seldom fail in reducing the pulse and relieving the breathing. If, however, after being used six or eight times, they are of no benefit, they should be discontinued. Opium, with stimulants, is generally a very safe and successful mode of treating those epizootic catarrhs, pneumonias, and rheumatisms, which are usually known under the common title of influenza, and which were long erroneously and fatally doctored by antiphlogistic remedies. A similar plan of treatment is also usually effectual in relieving asthma—a common complaint among dogs. Diarrhœa, occurring sometimes as an idiopathic complaint, and sometimes as a symptom of other diseases, is in either case often removed by giving a mild laxative to carry away those irritant matters on which it usually depends. But occasionally the complaint continues from a relaxed or irritable state of the intestines, and in such cases a few doses of opium will be an almost effectual cure, and may sometimes be advantageously united with acids, bitters, or vegetable astringents. In dysentery, whether in horses, cattle, or dogs, opium is of the greatest service, in allaying pain and straining, and may usually be freely given, both by the mouth and rectum. Where, however, there is much fever, it must be used cautiously, and laxatives may occasionally be necessary to remove any undue accumulation of feces. When applied to muscular tissue, opium, as already noticed, almost immediately produces a sedative effect ; and hence its inestimable value in relieving those spasmodic affections of the intestines which are so common among horses. It is, indeed, an almost indispensable constituent of all colic draughts, which usually contain besides, a stimulant, as sulphuric ether, sweet spirit of nitre, or oil of turpentine, and a laxative, as linseed or castor oil. Obstinate chronic vomiting seldom occurs in dogs, but when it does, it may generally be relieved by the exhibition of a few grains of opium daily. A few drops of chloroform or creasote have the same effect. In peritonitis, whether common or puerperal, the chief hope of cure lies in the frequent administration of large doses of opium, which render the patient less susceptible to the intense pain, thus enabling him the better to bear up against the disease. In enteritis also, it should be given immediately after bleeding. In all such cases, where acute pain is to be blunted or violent spasm counteracted, it should be given in very large doses and in solution. There is little fear of any bad consequences, for in such circumstances the system appears to attain great toleration of opium. Rheumatism is often advantageously treated with opium, which is used in the earlier and more acute stages of the disease with calomel; and in more advanced and chronic cases with ipecacuan, smart friction, and warm clothing. In tetanus, occurring in young animals from exposure to cold, it is often of permanent utility, and is also frequently used in more serious cases amongst adult animals to relieve the spasms and morbidly acute sensibility which characterise the disease. Its marked effect in retarding the action of the bowels is, however, a great objection to its employment in such cases. Many practitioners recommend it in rabies and chorea, but it is of little use in either. It was once largely used in diabetes; but is much less to be depended on than iodine. It has no power to arrest phthisis pulmonalis; but is often serviceable in relieving the cough and diarrhœa which accompany that malady. The administration of opium is contra-indicated in acute fever, with a hot and dry skin, and a full and strong pulse, in congestive and inflammatory diseases of the brain, and in obstinate constipation.

Opium is much used externally for relieving the pain of wounds, blistered and cauterised surfaces, and superficial inflammation of the eye, skin, or joints. When the skin is tender or abraded, it must, in small animals, be used with some caution, as it is apt to become absorbed, and produce its usual constitutional effects. It is of much value in cases of hemorrhoids, and as a soothing injection in enteritis, and in inflammatory affections of the kidneys and bladder. As an injection, it may be safely used in quantities two or three times as large as those in which it is given by the mouth.

Doses, etc.—The doses of opium vary much according to the purposes for which they are given. The average dose of solid opium for horses is from ʒi. to ʒij.; for cattle from ʒij. to ʒiv.; for sheep grs. x. to grs. xxx.; and for dogs gr. i. to grs. iij.

It is often given alone, but as already remarked is frequently combined with other medicines, many of which alter its effects, increasing some of its actions, and repressing others. To develope a sedative effect, it is combined with calomel, aconite, or tartar emetic; to cause a stimulant or antispasmodic action, it is given with sulphuric or nitrous ether; and to produce diaphoresis, it is conjoined with friction, exercise, and the use of diluents and ipecacuan.

The *preparations* of opium used in veterinary practice are less numerous than those employed in human medicine. *Crude opium* is often given to horses and dogs made into a bolus, and no other solid form is necessary. When required in the state of powder it must first be carefully dried in a vapour bath. Its trituration is materially facilitated by previously mixing it with a little sulphate of potash or other hard salt. The *extract of opium*, though somewhat less bulky than crude opium, is not a commendable preparation, for the high temperature to which it is generally exposed during its preparation diminishes its activity by causing the resinous matter of the opium to unite with the alkaloids to form a compound, which is insoluble and of comparatively little activity. *Dover's powder*, or rather the pharmaceutical imitation of that patent nostrum, consists of one part each of powdered opium and of ipecacuan, and eight parts of sulphate of potash, which is added to facilitate the trituration and intermixture of the vegetable matters. It is sometimes given to dogs as a febrifuge, in doses of grs. iij. to grs. viij.

A *watery solution*, made by rubbing down opium in hot water, is an excellent preparation for veterinary practice, being cheaper than the tincture, and more prompt and effectual than the solid drug. *Tincture of opium*, better known by its vernacular name of laudanum, is best prepared by the following process of the Edin. Phar.:—

"Take of opium, sliced, three ounces; rectified spirit, one pint and seven fluid ounces; water, thirteen fluid ounces and a half; digest the opium in the water at a temperature near 212° for two hours; break down the opium with the hand; strain and express the infusion; macerate the residuum in the rectified spirit for about twenty hours, and then strain and express very strongly. Mix the watery and spirituous infusions, and filter. This tincture is not easily obtained by the process of percolation; but when the opium is of fine quality, it may be prepared thus:—Slice the opium finely; mix the spirit and water; let the opium macerate in fourteen fluid ounces of the mixture for twelve hours, and then break it down thoroughly with the hand; pour the whole pulpy mass and fluid into a percolator and let the fluid part pass through, add the rest of the spirit without packing the opium in the cylinder, and continue the process of percolation till two pints are obtained."—(Ed. Phar.)

Every 13½ minims or 25 drops of this tincture should contain one grain of the active constituents of opium; and the tinctures of the London and Dublin Colleges are of the same strength. Laudanum, however, is very often adulterated, but its strength is easily tested by carefully evaporating a known quantity of it, and weighing the residuum. An ounce of good laudanum should leave from 17 to 22 grains of residue. The dose of laudanum for horses and cattle is from f℥i. to f℥iij., and for dogs from ♏ xv. to ♏ xxx.

The vinegar and wine of opium are scarcely ever used in veterinary practice. An ammoniated tincture of opium may sometimes be useful, and may be prepared with an ounce of opium to a pint of spirit of ammonia. An etherial tincture is easily made with one or two ounces of opium to a pint of sweet spirit of nitre.

"Opium liniment is prepared by the Pharmacopœia with Castile soap, six ounces; opium, one ounce and a half; camphor, three ounces; oil of rosemary, six fluid drachms; rectified spirit, two pints; macerate the soap and opium in the spirit for three days; filter, add the oil and camphor, and agitate briskly."—(Ed. Phar.)

This liniment may be made with more expedition by mixing laudanum and soap liniment, as directed by the London and

Dublin Colleges. It is only used externally as an anodyne, and occasionally for clysters, but for this latter purpose the tincture is generally preferred. In violent diarrhœa and dysentery, accompanied by pain and straining, there are few remedies more efficacious than injections of tincture of opium, mixed with warm starch gruel.

Muriate and Acetate of Morphia.

The two salts of morphia in common use in medical practice are the muriate, which is generally used all over Scotland; and the acetate, which is usually preferred in England. The former recommends itself as being more easily prepared, more soluble, and more readily preserved from change. It therefore deserves to be noticed first.

Muriate or Hydrochlorate of Morphia is got by macerating opium in water, when the meconate of morphia is dissolved out. Chloride of calcium is added to the solution, when mutual decomposition occurs, meconate of lime being precipitated, and muriate of morphia remaining in solution. The solution is concentrated, the salt of morphia is crystallized out, purified by strong pressure in flannel (which removes narcotine and colouring matter), and is then redissolved in hot water, and again crystallized. Several crystallizations with the use of animal charcoal are necessary to remove the last traces of colour. (See Ed. Phar.) When the process is carefully managed, good Turkey opium should yield from 10 to 12 per cent. of muriate of morphia.

Properties.—The salt generally occurs as a fine snow-white powder, consisting of broken down crystals, which, however, by the use of certain precautions, may be got entire in fine needle-like threads, which cluster together in radiated groups. It has no odour, but the same intensely bitter taste which characterises morphia and all its salts. It is permanent in the air, decrepitates when heated, and at high temperatures is charred, and gives off a strong, peculiar odour. It is soluble in its own weight of water at 212°, and in fourteen parts of water at 60°. It is readily soluble in alcohol. Nitric acid and perchloride of iron act upon it as on morphia itself. The intensity of the blue colour produced by perchloride of iron is a good criterion of the purity of the salt. Alkalies and lime water precipitate the alkaloid from a strong solution. Muriate of morphia consists of one equivalent of base, one of acid, and six of water.

Impurities.—Though not very liable to adulteration, it has occasionally been found to contain considerable quantities of sugar, sometimes so much as 20 or even 30 per cent. This sophistication might easily be prevented by purchasing the salt in crystals. Most specimens contain a trace of colouring matter, which does not, however, affect their medicinal properties. The same may be said of the small quantities of narcotine and codeia which are occasionally present. The following are the distinctive tests of pure muriate of morphia :—

"Snow-white; entirely soluble; solution colourless; loss of weight at 212° not above 13 per cent.; one hundred measures of a solution of ten grains in half a fluid ounce of water, heated near to 212°, and decomposed with agitation by a faint excess of ammonia, yield a precipitate which in twenty-four hours occupies 12·5 measures of the liquid."—(Ed. Phar.)

Actions and Uses.—Muriate of morphia possesses, in a concentrated form, all the actions of opium. In large doses, it acts on small animals (especially on carnivora) as a narcotic and sedative poison; and in medicinal doses, reduces the action of the heart, and allays irritation, pain, and spasm. When given for a short time, it produces constipation, and diminishes the amount of all the secretions, except that of the skin, which is more or less increased. It may be substituted for opium in almost all the many cases in which that drug is given.

Doses, etc.—The dose for horses and cattle is from grs. iij. to grs. x.; and for dogs, gr. $\frac{1}{4}$ to gr. i. It may be given in a bolus or in solution. The following solution is convenient on account of its being of the same strength as laudanum :—

"Take of muriate of morphia, one drachm and a half; rectified spirit, five fluid ounces; distilled water, fifteen fluid ounces; mix the spirit and water, and dissolve the muriate of morphia in the mixture, with the aid of a gentle heat." —(Ed. Phar.)

The dose of this solution is the same as that of laudanum, namely, about f℥i. for the larger animals, and ♏xv. or ♏xxx. for the smaller ones.

Acetate of Morphia is prepared by decomposing a solution of muriate of morphia by ammonia, and adding diluted acetic acid to the precipitated morphia. The salt is then dried at a gentle heat. It bears a close resemblance to the pure alkaloid, is snow-white and obscurely crystalline, with an intensely bitter taste. It is decomposed and dissipated by heat; is almost completely soluble in water, and entirely so in acidulated water and alcohol. It is distinguished from morphia and its other salts by the acetous odour which it evolves on the addition of sulphuric acid. It is a compound of one equivalent of base, one of acid, and one of water. It may be easily dispensed with in veterinary practice, for its actions and uses are identical with those of the muriate, which is preferable for the reasons already stated.

PEPPERMINT.

Mentha Piperita. Herb of *Mentha piperita.*

Nat. Ord.—Labiatæ. *Sex. Syst.*—Didynamia Gymnospermia.

The natural family *Labiatæ* yields many fragrant plants used in medicine as stomachics, carminatives, and anti-spasmodics, and in pharmacy as flavouring aromatics. The most important of these are mint, lavender, rosemary, marjoram, and thyme, all closely resembling each other in their properties, actions, and uses.

The only one of these requiring special notice is peppermint, a small, herbaceous plant, with a smooth annual stem, and oval, oblong petiolate leaves. All parts, but especially the leaves, have an agreeable aromatic odour, and a warm, bitter taste, followed by an impression of cold; and owe their properties to the presence of about one 320th part of a colourless or yellow volatile oil, which possesses, in a concentrated form, all the properties of the plant, and is obtainable by distillation with water. The herb itself is little used. The oil is occasionally prescribed in cases of indigestion, flatulence, and griping, in doses of about ♏xx. for horses and cattle, and ♏iij. for the dog. Its chief use is for disguising the flavour of unpalatable drugs, and preventing their nauseating and irritating effects. Peppermint water is prepared by distilling the herb (which should be collected while the flowers are beginning to blow) with water and a little rectified spirit. A strong spirit or essence of peppermint, very suitable either for medicinal or pharmaceutical purposes, is prepared by dissolving one part of the volatile oil in eight parts of rectified spirit. (Pereira).

The *M. Viridis*, or spearmint, and the *M. Pulegium*, or pennyroyal, have exactly the same actions and uses as the peppermint, but are scarcely so powerful.

PEPPERS.

Piperæ.

The *black and white peppers* in daily domestic use are obtained from the brown wrinkled berries of an East Indian climbing plant—the *Piper nigrum*. To prepare black pepper, the berries are pulled before they are ripe, dried in the sun, and ground without separating their outer covering. To prepare white pepper, the ripe berries are steeped in water, and their outer covering carefully separated before they are ground. The pepper so got is lighter coloured and milder than the other. Both sorts have, when bruised, a hot, pungent, spicy taste, and contain a white crystallizable substance called piperin, a bland volatile oil, and an oleo-resinous matter, which is believed to be their chief active principle.

Long pepper consists of small, closely-attached berries, arranged on cylindrical grey spadices about one or two inches long. When ground it exhibits all the properties of the common pepper.

Cubebs or *cubebæ* are the berries of the *Piper Cubeba*—a plant indigenous to the Spice Islands. The berries resemble those of the common pepper, are globular, rough, and wrinkled, with a grey-brown colour, a strong odour, and a pungent aromatic bitter taste. Their most important constituents are a volatile oil, and an acrid resinous principle called cubebin, which, however, is now believed by most chemists to be identical with piperin.

Jamaica pepper—pimento or *allspice*—closely resembles the true peppers in all important characters, and is the produce of a large tree of the natural family *Myrtaceæ*. The berries are about the same size as those of the *Piper nigrum*, have a penetrating aromatic odour and a hot pungent taste, but are more truly aromatic and less acrid than those of the common pepper.

Capsicum berries, also called Chilly pepper or Chillies, are brought from the East and West Indies. The several varieties differ much in their shape and size, but are all of a red colour, and filled with numerous seeds. They are seldom used whole; but, when dried and ground to powder, constitute the familiar *cayenne pepper*, which has a reddish-yellow colour, a faint disagreeable odour, and an acrid pungent taste. It owes its properties to an acrid oleaginous principle called capsicin.

Actions and Uses.—The different varieties of pepper are irritant, stomachic, and rubefacient. In large doses, especially in carnivora and omnivora, they act as irritant poisons, causing inflammation of the bowels, and sometimes also of the urino-genital organs, with general vascular excitement. The popular belief that they are especially poisonous to pigs is entirely fallacious. In smaller quantity they are stomachic and carminative, and in properly regulated doses exert merely a local action. When freely applied to the surface of the skin, they cause redness, irritation, swelling, and sometimes suppuration. The several varieties of pepper differ considerably in the degree or intensity of their action. The black pepper is more active than the white and long peppers, which are considered of nearly equal strength. Cubebs is less irritant and stimulant than any of the others, and is chiefly important on account of its power of arresting excessive mucous discharges. Pimento is also less active than the common peppers, is occasionally used as a carminative, and frequently as a flavouring aromatic; while capsicum and cayenne are more powerfully irritant than even black pepper.

Black pepper, which is the variety chiefly used in veterinary practice, is administered in simple indigestion; with other appropriate remedies in cases of colic; and for covering the disagreeable taste and preventing the nauseating effects of various drugs. It is not now given as a sialogogue; and ought never to be used with the irrational intention of developing or increasing the sexual appetite, which, when defective, may usually be restored, not by irritating drugs, but by measures which improve the general vigour. It is occasionally added to blistering ointments, and is also used for smearing setons. Ground pepper is one of those irritating substances which are sometimes introduced into the rectum of horses exposed for sale—a barbarous practice, which is apt to induce serious irritation, and even inflammation of the intestines.

Doses, etc.—The dose of black pepper, as a stomachic and carminative, is, for the horse, ʒij.; for cattle, ʒiij.; for sheep and swine, from ℈i. to ℈ij.; and for dogs, from grs. v. to grs. x. These doses may be repeated two or three times a day; and may be given made into a bolus, dissolved in water or spirit, or suspended in well boiled gruel, which is one of the best and safest ways of administering it. An ointment made with one or two ounces of ground pepper to the ounce of lard is sometimes used for external purposes.

PETROLEUM.

Barbadoes Tar.

Petroleum is a somewhat vague term applied to a class of bituminous substances which exude from the soil in many warm climates, varying in density and solidity from the hard brittle asphalt and mineral pitch to viscid mineral tar and fluid naphthas. The petroleum brought from Rangoon in Ava is obtained in unlimited quantities by digging into the soil, is of the consistence of paste, of a greenish-brown colour, and an agreeable bituminous odour. The variety known as *Barbadoes*, or *mineral-tar*, is found in the Island of Barbadoes floating on the surface of springs or pools, and in Trinidad, forming extensive beds or lakes. It is of a dull, greenish-brown colour, with a strong disagreeable and persistent naphthous odour, and a bitter acrid taste. Like other substances of the class, it becomes hard and pitch-like when exposed to the air; and, when heated, first liquifies, and by and by evolves a volatile naphthous fluid, leaving a solid residue of asphaltum. The fixed and volatile oils are its best solvents. It contains carbon and hydrogen, with a little oxygen and nitrogen.

Actions and Uses.—It is irritant, stimulant, diuretic, and anthelmintic. It was once much used as a specific in chest diseases, and as an anti-emetic; but as an internal remedy it has now fallen into disrepute. It is still, however, applied externally for the same purposes as wood-tar, particularly for the cure of cutaneous affections, chronic wounds, and many diseases of the feet.

POPPY HEADS.

Papaver. Imperfectly ripened capsules of *Papaver somniferum.*

Nat. Ord.—Papaveraceæ. *Sex. Syst.*—Polyandria Monogynia.

Poppy capsules are directed to be gathered about twelve days after the petals fall off. They are about the size of lemons. When fresh they are greenish-white, and filled with a milky-white bitter narcotic juice; but, when dry, they become yellow and brittle. They contain numerous small brown seeds, which are bland and nutritive, devoid of narcotic action, and filled with a mild fixed oil, familiar as the poppy-seed oil. Poppy heads contain a large quantity of mucilaginous matter, and a very small and irregular proportion of morphia. The watery infusion is sometimes used as an anodyne emollient, but is little, if at all, superior to solutions of gum or of linseed.

POTASSIUM AND ITS MEDICINAL COMPOUNDS.

POTASH. Potassa fusa. Caustic potash. Hydrate of potash, KO, HO.

SOLUTION OF POTASH. Potassæ aqua.

Aqua potassæ is prepared by boiling together carbonate of potash, or pearl ashes, and milk of lime. It is a dense oily-like fluid, without colour or odour, and with an acrid soapy taste, and an alkaline reaction on colouring matter. It unites with the soft animal and vegetable tissues, abstracting their watery parts, softening and dissolving them; and to this is owing its actions as a poison, and its uses as a caustic. Though little used in medicine, it is of much importance in chemistry and pharmacy, and in various other arts. When aqua potassæ is evaporated, until a drop removed on a stirrer becomes hard on cooling, and is then poured into small pencil-like moulds, it forms a dark grey, hard, crystalline body—*caustic potash*, or potassa fusa —which has all the well marked characters of aqua potassæ, and consists of potash with an equivalent of water. It readily unites with oils and fats forming soaps, and with acids forming neutral, soluble, crystallizable salts. Potash and its salts are identified by their giving in solution a crystalline yellow precipitate with bichloride of platinum, a granular white precipitate with tartaric acid; and when evaporated to dryness, and ignited with alcohol, a faint violet-coloured flame. From faulty preparation or bad keeping, caustic potash is apt to contain various impurities, especially oxide of iron, silica, and carbonates of potash, with other salts of that base. But these impurities seldom interfere with its medicinal actions.

Actions and Uses.—Potash is, in large doses, a corrosive and irritant poison; in medicinal doses, an antacid and diuretic; and is, besides, used externally as a caustic. When excessive doses are swallowed, either in a fluid or solid state, they dissolve, soften, and corrode the coats of the œsophagus and stomach sometimes so severely as to cause perforations. Orfila gave a dog thirty-two grains of caustic potash, which caused violent vomiting, restlessness, and death in three days. On post mortem examination, he found the mucous coat of the œsophagus and stomach red and black from extravasation of blood, with a perforation near the pylorus three-quarters of an inch in size, and surrounded by a hard thickened margin.—(Christison on Poisons.) The exhibition of small or highly diluted doses gradually interferes with digestion and assimilation, and destroys life by inanition. In poisonous doses it depresses the action of the heart, solely in virtue of its topical corrosive, and irritant effects, and does not appear to become absorbed, or to exert any general constitutional influence. To counteract the poisonous action of potash administer diluted acids, which form mild salts; and oils which produce soaps—themselves of service as demulcents, and in men and dogs as auxiliary emetics. Potash is rarely used internally, either in the fluid or solid state. When swallowed in medicinal doses, it is speedily converted into the carbonate with which it is consequently identical in action. On account of its alkaline properties it counteracts acidity in the stomach; and, in medicinal doses, is absorbed and excreted by the kidneys, increasing the quantity of the urine, and counteracting undue acidity of it—a condition, however, which seldom occurs amongst vegetable-feeding animals. The little sticks of caustic potash before adverted to are frequently used as a caustic for stimulating unhealthy ulcers and inducing suppuration; but, as they are very deliquescent, they must be applied with caution.

It will materially simplify the understanding of the general actions of the salts of potash to remember that they may be divided into two groups: 1*st*, Those which are topically corrosive, antacid, and antilithic,—such are potash and its compounds with carbonic acid; 2*d*, Those which are irritant, cathartic, diuretic, and refrigerant,—such are the sulphate, acetate, nitrate, and almost all the other salts of potash. A third group might also be added, including those salts which act rather like their acid or salt radicle half than their basyle half,—such are the sulphuret, iodide, and bromide of potassium.

Carbonate of Potash. Potassæ Carbonas. KO, CO^2.
Bicarbonate of Potash. Potassæ Bicarbonas. $KO, 2CO^2, HO$.

These two salts are obtained from the ashes of land plants. In the American potashes, in their partially purified condition of pearl ashes, there is present nearly eighty per cent. of carbonate of potash, with about twenty per cent. of sulphate of potash and chloride of potassium. These latter are less soluble than the carbonate, and are got rid of by dissolving the pearl ashes in an equal weight of water, pouring off the solution, and evaporating it to dryness. Where a very pure carbonate of potash is required, it may be got by burning together two parts of bitartrate of potash and one of nitre, adding water, and filtering and evaporating the solution. Carbonate of potash occurs sometimes in crystals, but generally in grains. It is white, opaque, and inodorous, with a strong acid taste, and an acid reaction on colouring matter. It is soluble in its own weight of water at 60°, deliquesces rapidly in the air; but, as it gradually absorbs carbonic acid, it slowly dries up again.

Bicarbonate of potash is prepared by passing a current of carbonic acid through a saturated solution of the neutral or monocarbonate; or, according to the directions of the Edin. Phar., by triturating together carbonate of potash and carbonate of ammonia, with sufficiency of water to make a smooth, uniform pulp, and drying this at about 140°, until all ammoniacal odour is removed. The bicarbonate, when slowly crystallized, occurs in transparent, colourless prisms; has a mild, saline, and slightly alkaline taste; dissolves in about four times its own weight of water at 60°; and when heated to redness, gives off carbonic acid, and becomes converted into the neutral carbonate, from which it is distinguished by its milder taste, by its remaining unchanged when exposed to the air, and by its giving, when in diluted solution, no precipitate with solutions of sulphate of magnesia or corrosive sublimate.

Actions and Uses.—The two carbonates of potash differ only in the degree of their action. Both resemble potash, but have their activity tempered and diminished by combination with carbonic acid. The neutral carbonate, when in concentrated solution, has much of the corrosive action of the pure alkali. Two drachms of it, given to a dog, caused vomiting, great agony, and death in twenty-five minutes. (Orfila). Its antidotes are the same as those for caustic potash. It is sometimes used medicinally as an antacid, but the cheaper and milder bicarbonate of soda is generally preferred. As a diuretic, it is less certain and active than the nitrate or acetate. In its impure condition of pearl ashes, it is sometimes applied externally as a stimulant and detergent. The bicarbonate is devoid of corrosive and irritant properties, but is antacid and diuretic. It is, however, seldom used in veterinary practice.

Doses, etc.—The dose of the neutral carbonate, as an antacid for horses and cattle, is from ʒiv. to ʒviij.; and for sheep and dogs, from grs. x. to grs. xl. These doses may be repeated several times a day, liberally diluted with water.

Sulphuret of Potassium. Liver of Sulphur. A Mixture of Per-sulphuret of Potassium (KS^3) and Hypo-sulphite and Sulphite of Potash, with a little Sulphate and Carbonate of Potash.—(Winckler).

This complex body is prepared by rubbing together an ounce of sulphur and four ounces of carbonate of potash, and keeping the mixture in a crucible over a fire until perfect union occurs. It has usually a whitish-green colour, but when freshly prepared, is liver-brown, and hence its old name, liver of sulphur. When dry, it is odourless, but when moistened, it smells of sulphuretted hydrogen. It has a bitter, acrid, alkaline taste, and is soluble in water.

Actions and Uses.—It is an irritant poison, similar in its actions to sulphur, but greatly more active. Two ounces are said to have destroyed a horse (Bouchardat); while six drachms and a half, introduced into the stomach of a dog, and retained there by a ligature on the œsophagus, occasioned death with tetanic symptoms in seven minutes; and a drachm and a half in small fragments, introduced into the sub-cutaneous cellular tissue of dogs, caused extensive inflammation, coma, and death in thirteen hours. (Christison). In many cases of poisoning, no very obvious morbid appearances remain after death, and hence it has been supposed to act chemically on the blood, in the same manner as sulphuretted hydrogen. It has sometimes been used medicinally in chronic coughs, rheumatic affections, and skin diseases, in doses of one to three drachms for horses and cattle, and two to ten grains for dogs. It was once considered a panacea for all kinds of poisoning, but is now used only in cases of poisoning by salts of lead, which it converts into a black insoluble, and almost inert sulphuret.

SULPHATE OF POTASH. Potassæ Sulphas. KO, SO^3.
BISULPHATE OF POTASH. Potassæ Bisulphas. $KO, 2SO^3, HO$.

The residue left in the preparation of nitric acid from equal parts of sulphuric acid and nitre, consists of sulphate of potash, with some excess of sulphuric acid, which may be got rid of by adding to the solution carbonate of potash or chalk, filtering and evaporating the mixture, when sulphate of potash crystallizes out in transparent, colourless, six-sided prisms, which have a sharp, saline, bitter taste, are hard and difficult to powder, and dissolve in five parts of water at 212°, and in sixteen parts at 60°.

The bisulphate is prepared by adding to the neutral sulphate its own weight of sulphuric acid, dissolving and crystallizing. It is a colourless, crystalline, soluble salt, with an acid taste and an acid reaction on colouring matter. It is distinguished from the neutral sulphate by its greater solubility, by its acid taste and reaction, and by its power of decomposing carbonates with effervescence, a property which has led to its being occasionally substituted for tartaric acid in making effervescing powders.

Actions and Uses.—In the human subject, large doses of sulphate of potash (in one case two ounces, in another ten drachms) are said to have proved fatal. Both sulphates are cathartic and diuretic. As cathartics, however, they are less prompt and certain than the sulphates of soda and magnesia; and as diuretics, are less to be depended on than the nitrate or acetate of potash.

The sulphate, on account of its being hard, and little apt to absorb moisture from the air, is much used for facilitating the trituration of tough vegetable substances, such as opium, ipecacuan, and jalap.

IODIDE OF POTASSIUM. Hydriodate of potash. Potassii Iodidum. K I.

Iodide of potassium is most cheaply and conveniently prepared by decomposing a solution of iodide of iron, with carbonate of potash. It crystallizes in colourless rhombic prisms, has a faint odour of iodine and a taste of common salt, decrepitates when heated, fuses at a red heat, at a higher temperature volatilizes unchanged, and dissolves in two-thirds of its weight of water at 60°, and in half its weight of boiling spirit. Both the aqueous and alcoholic solutions dissolve iodine freely, and are therefore most useful menstrua for its exhibition. The following tests of the Edinburgh College guard against all the common impurities of the salt :—

"Its solution is not affected, or is merely rendered hazy, by solution of nitrate of barytes; a solution of five grains in a fluid ounce of distilled water, precipitated by an excess of nitrate of silver, and then agitated in a bottle with a little aqua ammoniæ, yields quickly, by subsidence, a clear supernatant liquid, which is not altered by an excess of nitric acid, or is rendered merely hazy."

Actions and Uses.—Iodide of potassium closely resembles iodine in its actions and uses. In large doses it is irritant, and in medicinal doses diuretic and deobstruent. Two or three drachms dissolved in water, and given to dogs, caused vomiting, great depression, and death in a few days; one drachm had a similar effect on rabbits; while three drachms injected beneath the skin of the back of a dog, caused extensive subcutaneous inflammation and death in three days. The iodine was detected after death in the blood and urine, in the brain and spinal cord, in most of the internal organs, and even in the muscles and bones. (Cogswell.) Iodide of potassium, when administered even in doses of several ounces to horses or cattle, is devoid of irritant and poisonous properties, and acts only as a diuretic or as a mild cathartic. When administered in small and often-repeated doses, it appears in all animals to accelerate those changes of decay and reparation always going on within the body. It is prescribed in scrofulous enlargements of the glands, and in chronic rheumatism, and is, besides, used externally in the treatment of tumours. In veterinary practice, however, it is chiefly used as a convenient means of increasing the solubility of iodine, both in water and alcohol.

Doses, etc.—When used alone, the dose for horses and cattle is from ʒij. to ʒiv.; and for sheep and dogs, from ℈i. to ℈iij. These doses should be repeated three times a day, and given either in a bolus or dissolved in water.

Nitrate of Potash. Nitre. Saltpetre. Potassæ nitras. KO, NO^5.

This important substance is found in the East Indies, Persia, Egypt, Spain, and other warm climates, as a brown incrustation on the surface of the soil, and is formed by the potash of the soil fixing the nitric acid which is produced either from the direct union of the nitrogen and oxygen of the air, or, more probably, from the ammonia both of the soil and of the atmosphere. The saline efflorescence, which often covers large tracts of ground, is gathered about the end of summer; in India, usually about the month of November. It contains common salt, sulphate of soda, and nitrates of potash and of lime. It is dissolved in water, and mixed with impure carbonate of potash, which decomposes the nitrate of lime, forming insoluble carbonate of lime, and nitrate of potash. The solution is allowed to settle, and the nitre poured off in solution, and subsequently purified by repeated solutions and crystallizations. In France, and other continental countries, the salt is prepared artificially, by collecting into large heaps animal and vegetable refuse with old plaster, and other sorts of calcareous matter. The heaps are sheltered from rain, but freely exposed to the air, frequently watered with urine, and occasionally turned over. After about two years the whole is lixiviated, and purified by a process similar to that followed with the natural nitre.

Properties.—Nitrate of potash occurs in transparent, colourless, anhydrous, long-sided prisms. It has a sharp, cooling, saline taste, undergoes no alteration in air, deflagrates when thrown on flame, and dissolves in half its weight of water at 212°, and in four parts at 60°, causing, during solution, much abstraction of heat. When raised to about 600° it fuses, and the melted mass forms, on cooling, a hard, white, fibrous substance, known as sal prunelle.

Impurities.—The common impurities of nitre are sulphate of potash, chloride of potassium, nitrate of soda, chloride of sodium, and sometimes also a little lime. But none of these impurities are in sufficient quantity to interfere with its medicinal actions. The Edin. Phar. gives the following tests of its purity:—"Entirely soluble: its solution is not affected by solution of nitrate of baryta, and faintly, or not at all, by solution of nitrate of silver."

Actions and Uses.—Nitre is irritant, cathartic, diuretic, febrifuge, and refrigerant.

Quantities of half a pound for horses, and two or three drachms for dogs, cause inflammation of the alimentary canal and urinary organs, with subsequent depression and death, usually within twenty-four hours. (Moiroud.) Doses of several ounces usually cause purgation in horses and cattle, and vomiting in dogs; but these actions are uncertain, and apt to be accompanied by excessive renal irritation. The diuretic action is the most certain and useful of all the actions of nitre; is the result of the irritation which the medicine induces during its excretion by the kidneys; is readily produced in all the domesticated animals; and is expedited by giving the medicine in repeated doses, freely dissolved in water. The febrifuge action of nitre is partly owing to this diuretic effect, and the consequent removal from the body of large quantities of effete matters; and partly, it is believed, to the nitre maintaining the solubility of the fibrine of the blood, and preventing the aggregation of the corpuscules. This febrifuge action is synonymous with what is generally termed the alterative action of the drug, and is best developed by the exhibition of small and repeated doses. The refrigerant properties of nitre are exhibited when a freshly made solution is applied to the surface of the body, and are usefully employed in the cure of inflammation, especially when affecting parts of comparatively low vascularity.

Nitre is given to both horses and cattle in many different complaints, as in scantiness and turbidity of the urine, and in œdema and dropsical affections, in which it is usually prescribed along with other diuretics, and frequently with stimulants. In all febrile, inflammatory, and rheumatic affections it is also of much service, and is usually readily taken either mixed with soft food or dissolved in a pail of water. Few fever patients refuse to drink water containing even a considerable admixture of saline matters.

Many agriculturists give nitre to their horses in doses of about an ounce, mixed with a mash, every Saturday night. While the animals are on hard feeding this occasional dose of saline medicine appears to keep the bowels and skin in good order, and to ward off those attacks of swelled legs and weed which are apt to ensue. When hard-worked horses stand idle, care must, however, be taken neither to give more than an ounce at a time, nor to repeat the dose oftener than once a week.

Nitre, when dissolving in water, abstracts a considerable quantity of heat, and is consequently used as a refrigerant in apoplectic affections and inflammations about the joints and feet. Its efficacy is increased by admixture with salammoniac. Five ounces of nitrate of potash, with five of salammoniac, dissolved in sixteen fluid ounces of water reduce the temperature from 50° to 10° or through 40°. (Pereira).

Doses, etc.—The dose of nitre as a diuretic for the horse is about ʒvi.; for cattle, ℥i.; for sheep, ʒi. or ʒij.; and for dogs, ℈i. or ℈ij. It is usually given along with soap, resin, and other diuretics, which expedite and increase its action by determining its speedy excretion by the kidneys. There is no limit to the number and variety of recipes for diuretic balls. The mass used at the Edinburgh Veterinary College is thus made:—Take soap and nitre of each ℔s. ij.; resin, ℔s. iij.; Venice turpentine, ℔s. ij.; oil of turpentine, f℥viij. Melt the soap and resin over a slow fire; remove the mixture from the heat, and when it has somewhat cooled stir in the other constituents. The dose of this mass is ℥ij. Some practitioners substitute for the oil of turpentine an equal quantity of oil of juniper, and add when requisite linseed meal or flour. As a febrifuge, nitre is given in doses about half those used to cause diuresis, is repeated every two or three hours, and is usually conjoined with calomel, sulphur, or treacle. It used to be prescribed with tartar emetic, which, however, is now considered of little therapeutic value, either among horses or cattle.

ACETATE OF POTASH. Potassæ Acetas. $KO, C^4 H^3 O^3$.

The acetate of potash, made by neutralizing crude acetic acid with carbonate of potash, is a white foliaceous, soluble, deliquescent salt which closely resembles the nitrate in its actions and uses, and is much prized in human medicine as a diuretic. It is given in the same or somewhat larger doses than nitre.

ACID TARTRATE OF POTASH. Cream of Tartar. Potassæ Tartras. $KO, C^8 H^4 O^{10} + HO$.

The acid tartrate of potash is obtained in an impure state from the interior of wine casks, when it is called crude tartar or argol. When purified by solution and crystallization, it is in white, hard, crystalline masses, with a sharp acid taste. When administered in large quantities it causes in all animals inflammation of the alimentary canal. In doses of several ounces it operates on horses and cattle as a mild laxative, and in lesser quantities induces diuresis, and, like nitre, acts as a febrifuge.

PRUSSIC OR HYDROCYANIC ACID.

Acidum Hydrocyanicum. $H\ Cy$ or $H, C^2 N$.

Hydrocyanic acid derives that name from its being composed of hydrogen and the compound radicle cyanogen; and its more familiar appellation of Prussic acid from its being obtained from Prussian blue. It may be extracted from various plants, especially those of the *Amygdalaceæ*, or almond tribe, by crushing and moistening them with water, thus causing their emulsine, which is an albuminous or caseous principle, to excite in the amygdaline a species of fermentation from which hydrocyanic acid, a volatile oil, and some other products are formed.

There are two sorts of Prussic acid which it is important to distinguish—the anhydrous acid, and a diluted solution usually containing in this country from 1 to 5 per cent. of it. The latter alone is used medicinally.

Anhydrous Prussic Acid is one of the most active poisons known, and may be prepared by decomposing cyanide of silver with well-dried sulphuretted hydrogen, and collecting the vapour evolved in a receiver kept cold by a mixture of ice and salt. At 66° it is a colourless liquid, with a density of nearly 696. It is devoid of acidity, but has a strong pungent taste, and produces a feeling of acridity in the back of the throat. Its odour is generally likened to that of bitter almonds, or cherry-laurel water, but is perceptibly different from either, and entirely devoid of ratafia aroma. It unites both with water and alcohol; is very volatile; solidifies at 59° into a brittle fibrous mass; is inflammable; boils at 80°; and when dropped on the skin produces a sensation of numbness. It consists of one equivalent of cyanogen (C^2 N), and one of hydrogen, and speedily undergoes decomposition, being converted into a black substance partly consisting of paracyanogen.

The medicinal or diluted acid might be got by mixing the anhydrous acid with the requisite proportion of water, but this would be greatly more troublesome and expensive than preparing the diluted acid at once. It is always obtained by the decomposition of a cyanide, a salt consisting of cyanogen and a base, and usually analogous to a chloride. It may be got from almost any cyanide, and often in several different ways,—as from bicyanide of mercury by heating it with hydrochloric acid, as recommended by the Dublin College, or from the same salt by the action of sulphuretted hydrogen; from cyanide of potassium and tartaric acid; or, from cyanide of silver and hydrochloric acid, a convenient but expensive process, and chiefly suitable on the small scale, and for extemporaneous purposes. The process which is now most generally pursued, and which readily yields, at a very small cost, a pure and well-keeping acid, consists in the decomposition of ferro-cyanide of potassium (Fe Cy, 2 K Cy + 3 HO) by sulphuric acid. Both the London and Edinburgh Colleges have adopted this process. The following are the directions of the latter:—

"Take of ferrocyanide of potassium, three ounces; sulphuric acid, two fluid ounces; water, sixteen fluid ounces. Dissolve the salt in eleven fluid ounces of the water, and put the solution into a mattrass with a little sand: add the acid previously diluted with five fluid ounces of the water, and allowed to cool; connect the mattrass with a proper refrigeratory; distil with a gentle heat, by means of a sand-bath or naked gas-flame, till fourteen fluid ounces pass over, or till the residuum begins to froth up. Dilute the product with distilled water till it measures sixteen fluid ounces."—(Ed. Phar.)

The changes which occur in this process are complex, but the chief are the union of the iron with a portion of the cyanogen to form a blue compound, called Everitt's salt; the decomposition of water, the union of its oxygen with potassium to form potash, and the farther combination of this with sulphuric acid; and the union of the cyanogen, liberated from the potassium, with the hydrogen of the decomposed water, to form hydrocyanic acid.

Prussic acid, when kept even for a short time, is apt to volatilize and diminish in activity; and different specimens, even when carefully made by the same process, are liable to considerable variations of strength. As such variations in a poison so powerful might be attended by fatal consequences, it is important to notice the method of discovering and adjusting the strength of prussic acid. When nitrate of silver is added to it, there is formed a white precipitate of cyanide of silver, every five grains of which represent one grain of anhydrous acid. The strength of any specimen, or, in other words, the proportion of anhydrous acid which it contains, may therefore be readily determined by precipitating a known quantity of acid with solution of nitrate of silver, of pharmacopœia strength (one grain to forty of water), and collecting, drying, and weighing the precipitate. The weight thus got, if divided by five, gives the proportion of anhydrous acid which the specimen contains. 100 grains of Edin. prussic acid, carefully and freshly prepared, yields, when treated with nitrate of silver, 15 grains of a precipitate; and hence one-fifth of this, or three grains, is the amount of anhydrous acid present in it. The same quantity of London acid yields only ten grains of cyanide of silver, or contains only two per cent. of anhydrous acid. The strength of the Dublin acid is irregular, varying from about two to four per cent.

Properties.—These diluted acids possess, but in a less marked degree, most of the properties of the anhydrous acid. They have the same distinctive penetrating diffusible odour, cause the same numbness of the parts on which they are dropped, and being very volatile rapidly diminish in strength, unless kept in well stoppered bottles. Unlike the pure acid, they are not inflammable, do not spontaneously solidify or boil at such a low temperature, and may be kept unchanged for a long time if protected from broad daylight.

Tests.—Prussic acid is easily identified, even in small quantity and diluted solution. First amongst its tests for simplicity and accuracy is its characteristic odour, strong, diffusible, and penetrating; and, as above stated, readily distinguished from that of cherry laurel water, and bitter almonds, by the absence of ratafia aroma. Scheele's test, or the production of Prussian blue, is very delicate and characteristic. When the acid solution is rendered alkaline by caustic potash, and a solution containing a mixture of proto- and per-oxide of iron added, a greyish-green precipitate is thrown down, which, on the addition of a little sulphuric or hydrochloric acid to redissolve the oxide of iron, assumes a deep Prussian blue colour. If the original solution be treated with potash, and then with sulphate of copper, there is thrown down a green precipitate, which becomes white on the addition of a little hydrochloric acid to redissolve excess of oxide of copper. Nitrate of silver produces a white precipitate of cyanide of silver, soluble in ammonia and in hot nitric acid, but insoluble in cold nitric acid. The cyanide of silver is very similar in appearance to the chloride, but is easily distinguished from it by its solubility in hot nitric acid, and also by its evolving, when heated, cyanogen, which, if kindled, burns with a rose-coloured flame, surrounded by a blue halo. When a solution containing prussic acid is heated with hydrosulphuret of ammonia which has been previously boiled with sulphur, a new acid—the sulpho-cyanine—is produced, and gives a blood-red solution with a per-salt of iron. In testing for hydrocyanic acid in a complex liquid, such as the contents of the stomach, the acid, if in large quantity, might be volatilized, and condensed on a watch-glass moistened with nitrate of silver or hydrosulphuret of ammonia. But such a method would be ineligible where accurate results were necessary, and the poison existed in small amount. In such circumstances, the complex fluid should first be filtered and neutralised with sulphuric acid, and then distilled, and the clear liquid which first comes over tested in the usual way. As hydrocyanic acid is very readily volatilized, and is decomposed by many organic substances, it cannot usually be detected in the bodies of animals poisoned by it, unless they be examined within four or five days after death. It sometimes disappears even in a shorter time, if the body has been exposed to the weather.

Impurities.—Being for the most part prepared with care, prussic acid is generally made very pure; and its price, which is little more than a halfpenny per ounce, affords no temptation for intentional adulteration. Sulphuric acid is occasionally present, and is detected by nitrate of barytes. A trace of it, or of any of the other mineral acids, is said to improve the keeping properties of the acid. But pure prussic acid, when carefully prepared from ferrocyanide of potassium and sulphuric acid, and kept in well corked or closely stoppered bottles, may be preserved for months without undergoing any perceptible change. As prepared by some of the other processes, it often begins to blacken and decompose, even in a few days. The liability of prussic acid to irregularity of strength, and the best method of guarding against such irregularity, have been already mentioned. Another and very convenient way of testing the strength of the Edinburgh acid, and one which properly allows of variation to the amount of one-eleventh, is as follows :—

"Fifty minims diluted with one fluid ounce of distilled water, agitated with 390 minims of solution of nitrate of silver, and allowed to settle, will again give a precipitate with forty minims more of the test; but a further addition of the test after agitation and rest has no effect. The precipitate entirely disappears in boiling nitric acid."—(Ed. Phar.)

This test is very simple and convenient, tells its results at once, requires for its performance no costly chemical apparatus, and guards alike against excessive concentration and excessive dilution of the acid.

Actions and Uses.—There is no poison more active than anhydrous prussic acid. When injected into the jugular vein of the dog, it causes almost instant death. From one to four drops, weighing from a third of a grain to a grain and a fifth, placed on the tongue or within the eyelids of dogs, cats, rabbits, or such other small animals, begins to operate in from ten to thirty seconds, and proves fatal in about a minute—one or two deep, hurried inspirations, and a hurried convulsive expiration, being the only antecedents of death. From ten to twenty drops produce the same effect in horses. When given to small animals, as dogs and cats, in doses of ♏lx. to ♏xc., the medicinal acid sometimes acts with a rapidity scarcely inferior to the anhydrous acid; more commonly, however, life is prolonged for some minutes, and death is preceded by giddiness, convulsions, salivation, irregularity of the circulation, loss of the power of voluntary motion, tetanic spasms, flaccidity of the muscles, great debility, and sometimes coma. If the animal lives for an hour, perfect recovery may usually be expected.

The post-mortem appearances are not very different from those observed in animals dying from natural causes; and any abnormal appearances are much modified by the dose of the poison and the degree of its concentration. There is more or less venous congestion. The blood in all parts of the body is fluid, of a bluish appearance, and evolves the peculiar odour of the acid, which is sometimes also perceptible in the contents of the stomach, and in various of the secretions, especially that of the serous cavities. This odour, however, cannot be detected in many of the cases where life has been prolonged for some hours. When the strong acid has been administered, some experimenters find that the voluntary muscles and those of the intestines lose their contractility, and that the heart also loses its irritability and becomes gorged with dark grumous blood. There is, however, much difference of opinion concerning the state of the heart, and the appearances reported are not at all uniform. The villous coat of the intestines is sometimes red and shrivelled, and is easily removed.

The poisonous effects of prussic acid are observed in all animals, and ensue by whatever channel it enters the body, whether introduced into the stomach, injected into a vein, placed in the cellular tissue, or in a wound, or absorbed from a serous or mucous surface. Operating with great rapidity in whatever condition it is administered, it is especially active when in the state of vapour. Air saturated with it killed one dog in ten seconds, another in five, and a cat in two seconds. In combination with bases, it manifests the same tremendous energy, all the cyanides being very poisonous; the ferro-cyanides, however, are perfectly harmless. The symptoms produced by prussic acid, both in poisonous and medicinal doses, show that it acts chiefly on the brain and spinal chord. Its effects usually depend upon its being taken up by the blood-vessels, and not, as was long believed, by the transmission of a local impression along the nerves.

Various antidotes have been proposed for poisoning by prussic acid; but its effects are so rapidly fatal that, in the majority of cases, the animal is dead before any remedial measures can be adopted. Ammonia has long been in high repute, and is chiefly useful on account of its counteracting the mortally sedative effects of the poison. It should be given internally and also inhaled, but care must be taken that it be not too strong, otherwise it will irritate the fauces and other parts with which it comes in contact. Chlorine is a useful remedy, also acting beneficially as a diffusible stimulant. Cold affusion has been effectual in very aggravated cases, both in man and the lower animals. It should be applied only to the head, and should be continued at short intervals for a long time. Bleeding from the jugular vein is often useful, as it relieves congestion of the lungs, and of the right side of the heart. Dogs even in the last stages of poisoning have been roused and recovered by this remedy. By far the best chemical antidote at present known was discovered by the Messrs Smith of this city. It consists in the conversion of the acid into the insoluble and inert Prussian blue, by giving a solution of carbonate of potash, followed immediately by a mixture in solution of the proto- and per-sulphate of iron. The solutions used by the Messrs Smith consist of 144 grains of carbonate of potash dissolved in two ounces of water; and a drachm and a half of the proto-sulphate of iron, mixed with two drachms of the same, dissolved in two ounces of water, and made into per-sulphate by heating with a little nitric acid and half as much suphuric acid as it already contains. ♏ 52 of each solution remove all the acid present in ♏ 100 of Edinburgh prussic acid; but to ensure success three or four times these proportions should be used. If ever called on to treat a case of poisoning by hydrocyanic acid either in man or the lower animals, the practitioner should not, however, content himself with using one of these remedies, but ought to employ several or all of them. While solutions of carbonate of potash and of the mixed sulphates of iron are being prepared as speedily as possible, he should at once use the lancet freely, drawing blood rapidly from a large orifice in the jugular; then place the head and neck of the patient under a stream of cold water, and cause him also to inhale ammonia.

In medicinal doses, hydrocyanic acid diminishes the force and frequency of the pulse, allays pain, irritation, and spasm, and is consequently used as a sedative, calmative, and antispasmodic. It is efficacious in cases of chronic cough where there is no organic disease; in spasmodic affections, as chorea, epilepsy, and chronic vomiting; and in functional palpitation of the heart and rheumatism. Much advantage often seems to attend its use in mild cases of tetanus, especially in young animals, in which it causes remission of the spasms and the other symptoms; but in aggravated cases, and in aged animals, it is of little permanent use. It has been occasionally used externally for allaying the irritation of cutaneous eruptions and ulcerations. In using hydrocyanic acid as a medicine, the doses should at first be small, and, until perfectly regulated, the effects produced must be carefully watched. The occurrence of nausea, or any of the constitutional effects of the medicine, indicates the necessity of at once stopping its administration, or reducing the dose. It does not appear to have any cumulative effect, so that in well-regulated doses it may be given with perfect safety for a long time. When a fresh quantity of the medicine is got, the dose should at first be considerably reduced to guard against any undue increase of strength.

Doses, etc.—The doses for horses and cattle are from ♏xx. to ♏xxx.; and for dogs, ♏i. to ♏iij. It may be given in water sweetened with simple syrup; and, as its calmative effects are very transient, the doses should be repeated from three to five times a day. To prevent the mistakes which are apt to arise with a colourless liquid, it is often made up with compound tincture of cardamoms. When used externally it should be largely diluted with water.

PYROXILIC SPIRIT.

Medicinal Naphtha. $C^2H^3O + HO$.

This compound bears a close resemblance to alcohol in its properties and composition. It is the hydrated oxide of a hypothetical radicle called methyle (C^2H^3); as alcohol is the hydrated oxide of a similar radicle ethyle (C^4H^5). It must be carefully distinguished from the naphtha of wood or gas, which is a pure carbo-hydrogen (p. 295). Medicinal naphtha is usually prepared by neutralizing crude pyroligneous acid with lime, distilling the pyrolignite of lime thus formed, and purifying the spirit by redistillation from quick-lime. (Ure and Christison). It is a colourless fluid, which gradually becomes yellow by keeping. It has a peculiar agreeable spirituous odour, and a warm aromatic taste. Its density is about 846. It is volatile and inflammable, mixes with water in all proportions, and forms a cheap and convenient solvent for many organic substances.

Actions and Uses.—It is narcotic, sedative, and antiseptic; and has been occasionally used in veterinary practice to relieve chronic coughs; to allay irritability of the stomach and vomiting in dogs; to serve the various purposes of an active antiseptic; to dissolve the active principles of many vegetables; and, on account of its inflammability, to singe the hair of horses.

RHUBARB.

Rheum. Root of *Rheum palmatum*, and other Species of *Rheum*. —(United States Phar).

Nat. Ord.—Polygonaceæ. *Sex. Syst.*—Enneandria Monogynia.

The botanical sources of medicinal rhubarb are almost unknown. It is believed that the plant or plants yielding it grow wild in Central Asia, but they have not as yet been seen or identified by any European naturalist. The known plants of the family are herbaceous, have a perennial succulent branching root, a tall flowering stem, sheathing leaf-stalks, and large heart-shaped leaves, with cut and wavy margins, and possessing, in common with the leaf-stalks, a pleasant acid taste, due to the presence of malic and oxalic acids.

Varieties.—Three sorts of rhubarb are met with in British commerce, Russian, Chinese or East Indian, and European or English.

RUSSIAN RHUBARB, often improperly termed Turkey Rhubarb, is collected during summer from the mountain ranges of the interior of China and Tibet. The root is taken up when from four to eight years old, is carefully cleaned, cut in pieces, and dried. It is brought usually on camels to Kiachta, there examined by the emissaries of the Russian government, and thence despatched to Moscow and St Petersburgh. It occurs in irregular, cylindrical, sometimes slightly flattened pieces, varying from one to three inches in breadth; is covered with a yellow dust of powdered rhubarb; is entirely stripped of its epidermis; has a regular compact appearance; and is marked with red, white, and yellow streaks. The hole through which the cord passed, on which the piece hung to dry, can usually be easily detected. The odour is strong, peculiar, and aromatic, and the taste astringent and bitter. It is gritty, owing to the presence of crystals of oxalate of lime, and when chewed communicates a yellow colour to the saliva. It is easily reduced to a bright yellow powder. It is the finest of all varieties of rhubarb, and always commands the highest price.

Chinese or East Indian rhubarb is of several different kinds, most of them much inferior to the Russian variety. Its sources are not very different from those of the first-mentioned variety. It is imported from Canton and Singapore, has a dull yellow colour, a dense compact structure, is imperfectly denuded of the root bark, and is often stained by damp or spoilt with insects. It is readily distinguished from the Russian rhubarb by its uneven, dull, red-brown fracture, its coarse fibre, brown powder, and want of aroma. The Siberian and Himalayan rhubarbs are merely varieties of the Chinese rhubarb.

English Rhubarb is chiefly grown at Banbury in Oxfordshire, where about twelve acres of the *Rheum rhaponticum* are cultivated annually. (Pereira.) The roots of three or four years' growth are taken up in October or November, cleaned, decorticated, and dried, first in the air, and then by artificial heat. The produce, however, is inferior to the Russian and East Indian rhubarbs, is of a loose spongy structure, contains often hard woody knots, and has a red or pink hue, a feeble disagreeable odour without aroma, and a mucilaginous taste, with little if any grittiness.

Chemical Properties.—Rhubarb is readily dissolved by ether, alcohol, and proof spirit; and somewhat less readily by cold and hot water, with the latter of which it forms an orange-coloured solution, which gradually becomes turbid from separation of rheine. Besides lignine, a small quantity of an odorous volatile oil, three acrid resins, and the ordinary constituents of vegetables, rhubarb further contains a peculiar neutral principle called *rheine* or *rhabarberine*, and once believed to be the active ingredient. The active principle, however, does not as yet appear to have been isolated. Rhubarb is often adulterated by mixing the inferior qualities of home growth with the finer Eastern varieties—a fraud which is best discovered by a careful examination of the suspected specimen.

Actions and Uses.—Rhubarb is tonic, astringent, and cathartic. In small and repeated doses it improves the appetite, facilitates digestion, and when given for some time may be detected in the blood, urine, and occasionally in the milk. In larger doses it acts in the dog and other carnivora as a cathartic; but in herbivora and graminivora, it has scarcely any purgative effect. Several ounces, and sometimes even a pound, have been given to cattle without moving the bowels; while from nine ounces to a pound caused in the horse only a slight laxative effect after thirty-six hours. (Moiroud). In purgative doses it is believed to act chiefly on the stomach and duodenum. It is generally said specially to increase the secretion of bile; but this is by no means established. When applied to the skin or mucous surfaces, it acts as an astringent, and hence constipation very commonly succeeds its primary cathartic effect. On this account it is particularly useful in many cases of diarrhœa and dysentery, as it first removes the cause of irritation, and then acts as a mild vegetable astringent. Rhubarb is not much used in veterinary practice. It is given as a tonic in enfeebled digestion, especially in young animals, and occasionally as a laxative for the dog.

Doses, etc.—As a stomachic and tonic it is administered several times a day to horses, in doses of ʒi.; to cattle, in doses of ℥ij.; to sheep, in doses of ʒi., and to dogs and cats, in doses of grs. x. to grs. xxx. As a laxative for the dog, the dose is ʒij. or ʒiij., usually combined with one or two grains of calomel or a scruple of jalap.

Rhubarb is generally used in the form of simple powder, and occasionally as an infusion or tincture. The compound powder of rhubarb, or Gregory's mixture, is prepared by mixing thoroughly a pound of magnesia, two ounces of ginger, and four ounces of rhubarb—all in fine powder. It is a stomachic and antacid, and may be given in doses twice as large as those of the simple rhubarb. In chronic diarrhœa and dysentery in calves and foals, many veterinarians recommend rhubarb, magnesia, and opium, in doses of a drachm each, given several times a day in flour gruel, with a tablespoonful or two of brandy or sweet spirits of nitre.

SOAP.

Sapo.

Soap is prepared by boiling alkaline solutions with oleaginous matters, which are thus separated into a sweet, basic body, called glycerine, and several fatty acids, chiefly the oleic and margaric, which unite with the alkali, leaving the glycerine dissolved in the water. Soap is therefore an oleate and margarate of soda or potash. It has an acrid, alkaline taste, and dissolves readily in water. When heated, it fuses, swells up, and decomposes, leaving charcoal and carbonate of the alkali. Hard soaps are prepared with soda, and soft soaps with potash. The superiority of the toilet soaps depends on the fine quality of the oleaginous matters used in their manufacture.

Actions and Uses.—Soap is mildly laxative, diuretic, and antacid; and is, besides, used as an external stimulant and excipient. It is not used alone either as a laxative or diuretic, but forms a convenient adjunct to other more active medicines, and an excellent addition to laxative clysters. As an antacid, it is less efficacious than the carbonates or bicarbonates of the alkalies or alkaline earths, but is often used as an antidote in poisoning by acids and metallic salts. It is a good stimulant for bruises and strains; and a convenient preparation for such purposes may be made by mixing six ounces of soap and one pint each of proof spirit, liquor ammoniæ, and linseed oil or oil of turpentine. To this may also be added two or three ounces of camphor. In grease, mange, and other cutaneous diseases, the diligent use of soap and water is very effectual, both as a means of prevention and of cure.

Soap is much used in pharmacy as an excipient for boluses, and for making up many ointments and liniments.

SAVIN.

Sabina. Tops of the *Juniperus Sabina.*

Nat. Ord.—Coniferæ. *Sex. Syst.*—Diœcia Monadelphiæ.

The *Juniperus Sabina* is a small, shrubby, evergreen plant, a native of Southern Europe, but easily cultivated in this country. The officinal parts are the tops or young branches, with their attached leaves. When fresh they are green, but become yellow when kept, have a strong, heavy, disagreeable odour, and a bitter, acrid, resinous taste. They owe their activity to the presence of a volatile oil, and communicate their properties to water, spirit, and the fixed oils.

Actions and Uses.—Savin is, in large doses, an irritant poison. A dog which got ʒiv., and had the œsophagus tied to prevent vomiting, died in thirteen hours. The stomach on examination was found red, and the rectum inflamed. (Orfila.) Death also occurs with the usual symptoms of irritant poisoning, when powdered savin is placed underneath the skin or applied to a wound. Orfila believes its effects to depend on its "absorption and its action on the nervous system of the rectum and the stomach." In large doses it also irritates the kidneys and bladder, often causing a copious discharge of bloody urine. It is believed to have a special effect on the uterus, and on this account is occasionally used by non-professional persons to produce abortion or hasten parturition. It is only, however, in poisonous doses, in doses so great as to produce violent intestinal inflammation that these effects are attainable. It is occasionally used for the destruction of intestinal worms, but is neither so safe nor so certain as oil of turpentine. If used at all, the essential oil is the best form of administration. Both the tops and the oil are occasionally applied as stimulants for indolent sores and warts, and for keeping up the discharge from blisters and setons.

Doses, etc.—As an anthelmintic, the dose of the oil for cattle or horses is about f℥iij. or f℥iv.; and for the dog ♏iij to ♏v. It may be conveniently dissolved in any fixed oil. For external application an infusion made with one part of the fresh tops to six or eight parts of water is sometimes used. The ointment, however, is generally preferred, and is thus directed to be prepared :—

"Take of fresh savin, two parts; bee's wax, one part; axunge, four parts. Melt the wax and axunge together, add the savin, and boil them together till the leaves are friable, then strain."—(Ed. Phar.) A mixture of equal parts of this and of verdigris ointment is often useful.

SILVER AND ITS MEDICINAL COMPOUNDS.

NITRATE OF SILVER. Lunar caustic. Lapis Infernalis. Argenti nitras. $Ag\ O,\ NO^5$.

The nitrate is the only preparation of silver of any medicinal importance. It is prepared by heating metallic silver with nitric acid. Oxide of silver is first formed by the decomposition of a part of the acid, and is subsequently united with the undecomposed acid. When the salt is to be used as a caustic, the water is expelled by fusion, and the product run into small pencil-like moulds. These sticks, or pencils of nitrate of silver, have a radiated crystalline structure, and, when freshly prepared, are of a steel-grey colour, which gradually darkens on exposure to air and light. Nitrate of silver, when crystallized, occurs in transparent, colourless, tabular crystals. It is devoid of odour, has a disagreeable, caustic, metallic taste, remains permanent in the air, but blackens when exposed to light or to contact with organic matters. It is soluble in its own weight of temperate water, and in four parts of rectified spirit. It blackens the cuticle, and corrodes the soft animal tissues. Like other salts of silver, it is distinguished by giving with sulphuretted hydrogen and hydro-sulphuret of ammonia, a black precipitate, and with hydrochloric acid, a white precipitate, insoluble in nitric acid, but soluble in ammonia. Nitrate of silver is not very liable to adulteration. Nitrate of potash, with salts of lead, zinc, and copper, which are its most common impurities, may be discovered by adding hydrochloric acid to a solution until precipitation ceases, and then testing the clear solution for the suspected impurities.

Actions and Uses.—Salts of silver closely resemble those of copper and zinc in their general actions. In large quantity, they are corrosive and irritant; and in less quantity, tonic, stimulant, and astringent. The nitrate, when given to dogs, in doses of one or two scruples, acts as a topical irritant, causing fatal gastro-enteritis. It is most powerful when given in concentrated solution. When administered in repeated medicinal doses it becomes absorbed, and is discoverable in the liver and spleen, and also in the structure of the skin, where it produces an indelible black stain, an effect which has occasionally followed its continued administration in man. It is highly recommended by some practitioners as a tonic for the dog, and is said to be of special benefit in chorea, epilepsy, and other nervous diseases. It has scarcely ever been employed either for horses or cattle. In veterinary practice it is chiefly used externally as a caustic, stimulant, and astringent, actions which it owes chiefly to its uniting with the albuminous matters and salts of the tissues. It is applied for the removal of fungous growths, warts, and angle-berries; and for the improvement of indolent sores, mange, ring-worm, and other chronic skin diseases. It is one of the best stimulant applications for conjunctivitis, and such other limited and superficial inflammations, being beneficial chiefly on account of its primary astringent, and subsequent sedative effects. On account of its increasing the vascular activity of the surrounding parts, it is often effectual in removing specks and opacity of the cornea, especially if of recent origin, and produced by accidental causes. Where, however, these have resulted from repeated attacks of deep-seated or periodic ophthalmia, nitrate of silver, as well as all other remedies, will be fruitless. On account of its uniting with the sulphur of the hair to form the black sulphuret of silver, the nitrate is frequently used as a hair-dye. In human practice it has been recently much recommended for the treatment of scalds and burns, and for preventing the spread of erysipalatous inflammation. Where an undue quantity of nitrate of silver has been employed either internally or externally, its injurious consequences are best counteracted by the use of common salt, which unites with it to form an insoluble and inert chloride of silver.

Doses, etc.—The dose of nitrate of silver as a tonic for the dog, is from one-eighth to one-half of a grain, repeated three or four times a day. On account of its disagreeable taste it is best given in the condition of a bolus. For external application it is generally used in the form of little sticks, which are coated with wax, to preserve them from the decomposing action of air and light, and held in quills or forceps to prevent their blackening the fingers. For some purposes an ointment is useful, and may be made with from grs. v. to grs. viij. of the salt of silver to every ounce of lard. The strength of the solution must vary with the uses to which it is applied. From grs. iij. to grs. x., is the usual strength for collyria. Solutions must be protected from the light, and kept in bottles with glass stoppers.

SODIUM AND ITS MEDICINAL COMPOUNDS.

CARBONATE OF SODA. Sodæ carbonas. $NaO, CO^2 + 10\ HO$.
BICARBONATE OF SODA. Sodæ bicarbonas. $NaO, 2CO^2 + HO$.

Carbonate of soda, formerly largely prepared by lixiviating the ashes of marine and maritime plants, is now chiefly obtained from common salt, by heating it with sulphuric acid, reducing the sulphate so formed to the state of a sulphuret, by roasting with charcoal, fusing the sulphuret with carbonate of lime, lixiviating the product, and purifying it by repeated crystallizations. Carbonate of soda occurs in large, clear, colourless crystals. It is alkaline, soluble in water, and like other soda salts, distinguished by its negative action with sulphuretted hydrogen, hydrosulphuret of ammonia, and carbonate of potash, and its communicating to burning alcohol a bright yellow flame.

Carbonate of soda, when exposed to carbonic acid, freely absorbs it, becoming converted into the bicarbonate—a white, opaque, soluble powder, distinguishable from the neutral carbonate by its feeble alkalinity, and its giving no precipitate with sulphate of magnesia, and only a faint opalescence with corrosive sublimate.

Actions and Uses.—The carbonate and bicarbonate of soda differ only in the degree of their action, and closely resemble the corresponding salts of potash in their effects. They neutralize acidity in the alimentary canal. They are useful in indigestion and other complaints depending on acidity, and in poisoning by acids. They become absorbed, and while in the blood appear to alter, in some inexplicable way, its constitution as well as that of the soft solids. They are thus serviceable in relieving febrile attacks, rheumatism, and other abnormal conditions of the system. They pass out of the body by the kidneys, increasing the quantity and alkalinity of the urine, and are consequently used as mild diuretics, and also occasionally in men and dogs as antilithics. They have been recommended by continental veterinarians as lotions for skin diseases.

Doses, etc.—The dose of the carbonate for horses and cattle varies from ʒij. to ʒvj.; for sheep, from ℈i. to ℈iij; and for dogs, from grs. x. to grs. xx. The doses of the bicarbonate are double those of the carbonate. Both salts may be given either in bolus or solution.

SULPHATE OF SODA. Glauber's Salt. Sodæ Sulphas. $Na\,O, SO^3 + 10HO$.

Sulphate of soda is found as an efflorescent crust on the surface of the soil in various parts of India, and is also a constituent of many aperient mineral waters. It is chiefly obtained by crystallizing the residuum remaining in the retorts after the preparation of hydrochloric acid. It occurs either in large rhombic prisms, or in needle-like crystals, and is colourless, transparent, and of a saline, bitter, nauseous taste. It is soluble in three parts of water at 60°, and, like most other salts of soda, effloresces when exposed to the air.

Actions and Uses.—It is cathartic and diuretic. Like other saline purgatives, it acts very irregularly on horses. Among cattle it is less effectual than sulphate of magnesia or common salt, and more apt to act on the kidneys. In the dog it acts both as an emetic and purgative. It is applicable to all the purposes of a saline cathartic; but is now little used in veterinary practice, except occasionally for cattle.

Doses, etc.—The dose as a purgative for cattle is from ℔. j. to ℔. iss, given with ginger and treacle, and succeeded by as much water as the animal can be induced to drink.

BISULPHITE OF SODA. Sodæ Bisulphis. $Na\ O,\ 2\ SO^2$.

Bisulphite of soda is now manufactured for the dyer at various chemical works, by passing a current of sulphurous acid through a concentrated solution of carbonate of soda. The salt is readily crystallizable in four-sided prisms, and has an acid taste and reaction, with an odour of sulphurous acid. It acts most energetically as an antiseptic and deodoriser, is probably a good disinfectant, and has been much recommended for the cure of tympanitis and hoven. In such cases it deserves further trial, for it is undoubtedly a most effectual means of counteracting fermentation. The dose for horses and cattle is about ℥i., and for dogs ℈i., given in solution, at short intervals, until the cure is complete.

CHLORIDE OF SODIUM. Common Salt. Muriate of Soda. $Na\ Cl$.

Salt is found in the bosom of the earth in immense strata, as in Cheshire, Poland, and Spain. It exists in variable amount in every soil, and hence in every water. It is the largest saline constituent of the ocean, and abounds in the tissues of all plants and animals. It is obtained for medicinal and economical purposes by quarrying the solid beds of rock salt; or by evaporating brine springs or sea water. It forms cubical crystals which vary in size according to the rapidity of their formation, and are soluble in two and a half times their weight of water at all temperatures. It is rather more than twice as heavy as water.

Actions and Uses.—It is irritant, cathartic, emetic, stimulant, and antiseptic; and is, moreover, a valuable dietetic substance.

On horses its cathartic action is uncertain, often violent, and usually accompanied by considerable irritation of the kidneys. On dogs it usually operates as an emetico-cathartic, being much used to clear out the stomach and intestines, and to induce that reduction of the action of the heart which accompanies the operation of most emetics. On pigs also it acts as a purgative, but less certainly than aloes or croton. For ruminants it is the most useful of all cathartics. In them, it is more prompt and powerful than Epsom salt or other saline substances; and, by causing thirst, induces the animal to drink large quantities of water or other bland fluids. This ingestion of large quantities of fluid is of inestimable advantage in torpidity of the bowels and constipation among cattle, by softening and carrying onwards the hard, dry, feculent matters, which are so apt to accumulate in the stomach, and resist the action of ordinary purgatives. Among cattle and sheep, it is extensively used for all the ordinary purposes of a purgative. It is administered to evacuate the bowels in distension of the stomach with food, in fardel-bound, and in diarrhœa depending on over-feeding, or kept up by the presence of irritating matters in the alimentary canal. It is also given to relieve irritation and inflammation of the eyes, brain, respiratory organs, or limbs, by exciting counter-irritation, diminishing the watery constituents of the blood, freeing it of peccant matters, and restoring the bowels to a healthy state. In small and repeated doses, salt is a valuable stomachic, and is useful in all animals in indigestion and irregularity of the appetite. It is also said to counteract any tendency to the production of intestinal worms, to prevent rot in sheep, and to obviate, in great measure, the evil effects of damp and badly kept fodder. It is a common addition to laxative clysters; and from its action as a stimulant, as well as from the cold which it produces during solution, it is beneficially applied in various affections of the joints, and in some diseases of the feet, particularly amongst cattle and sheep.

The frequent use of small quantities of common salt, appears to be of much service in maintaining the domesticated animals in a state of high health. Indeed, so essential is it, that animals in a state of nature will often instinctively travel many miles to reach saline springs, the sea-shore, or incrustations or beds of salt. Some years ago, M. Boussingault made some very interesting experiments regarding the dietetic value of common salt.[1] He selected six cattle, divided them into two lots as equal as possible in weight and appearance, and fed them in exactly the same manner, except that the animals in the one lot received each 1·2 ounces of salt daily, whilst those of the other got none. In about six months, the skin and hair of the latter became rough, dry, and staring, presenting a striking contrast to the smooth, oily coats of the others, which, though not much superior to their neighbours in weight, were more lively, and of so much better appearance that they brought a somewhat higher price. It is also worthy of remark, that the cattle receiving salt, exhibited throughout much greater appetite and relish for their food, consumed it in a shorter space of time, and also drunk larger quantities of water. The use of salt is especially necessary for animals receiving cooked food, grains, or roots, for the salt naturally present in such articles is usually in small amount. But all animals should have access to salt at all times. A piece of rock-salt should constantly lie in the horse's manger, the ox's crib, and the sheep's trough. The fondness which animals show for salt, and the frequent perseverance with which they lick at it, indicate that the condiment gratifies the taste, and probably also serves some useful purposes in the body. It is thought to be the natural stimulant of the digestive system in all animals; to become decomposed and afford chlorine for the hydrochloric acid of the gastric juice, and soda for the bile; to perform some important functions in regard to the blood discs; and to assist the blood in maintaining its "fluidity, its stimulating properties, and its powers of self-preservation."

Doses, etc.—The dose of common salt, as a purgative for the adult ox, varies from lb.$\frac{3}{4}$ to lbs. jss.; and for sheep, from ℥i. to ℥iij. It should be dissolved in a large quantity of water, conjoined with ginger, or other aromatics, and made as palatable as possible by admixture with treacle. When so made up, many animals will readily drink it, and the trouble of horning it over may thus be saved. In treating derangements of the digestive

[1] Annales de Chemie et de Physique for 1847, vol. xix.

organs, and other cases among cattle, it is often necessary to expedite and increase the effects of common salt by the addition of ʒij. or ʒiij. of calomel, or fifteen or twenty croton beans. Where such a dose fails to act in twelve or fifteen hours, it may be again repeated exactly as before, or with a pint or two of linseed oil instead of salt. Frequently reiterated large doses of salt, or indeed of any active purgative, are, however, to be avoided, since they induce much nausea and depression, which actually prevent purgation. When a patient has got two, or at most three full doses of physic, without effect, he should have frequent clysters, plenty of treacle, and as much salt and water, or simple water, as he will drink of his own accord, but rarely any more active cathartic medicine. As an emetic for the dog, from one to four drachms are given, dissolved in tepid water.

Chloride of Soda. Hypochlorite of soda. Labarraque's soda-disinfecting fluid (contains one part of this salt dissolved in one of water).

Chloride of soda closely resembles chloride of lime or bleaching-powder in its composition, properties, and actions. It is prepared by saturating carbonate of soda with chlorine gas. It is a soft white powder, with a strong chlorine odour, and an astringent alkaline taste. It is easily dissolved in water, forming a yellow solution, which readily destroys vegetable colouring matters. Pereira believed it to consist of two parts of bicarbonate of soda, one of chloride of sodium, and one of hypochlorite of soda, which is its chief active constituent.

Actions and Uses.—It is stimulant, antiseptic, and disinfectant. It has been recommended in typhoid affections; and from the idea that it has some peculiar action on the lymphatic glands and vessels, it has also been given to horses in cases of glanders and farcy, but without much success. Doses of one pound are said to have been used with impunity. It is chiefly employed to arrest putrefaction, remove offensive odours, and destroy contagious miasmata; but even for these purposes it has been superseded by bleaching powder, which is equally efficient, and much cheaper.

SPERMACETI.

Cetaceum. A concrete substance, found in cells in the head of the Physeter macrocephalus, or sperm whale.

Spermaceti is nearly allied to the fats and solid oils, and is found in the cells of the large quadrangular head of the sperm whale, which inhabits the Pacific and Indian Oceans. It is extracted by openings made through the skull, and occasionally by boiling various parts of the cellular and adipose tissues, which do not, however, yield it so abundantly as the head. When purified by melting, straining, and solution in weak potash-ley, it is a soft, slightly oily, white, pearly, crystalline substance, with the density 943. It is tasteless, odourless, tough, and difficult to powder, unless previously moistened with a few drops of spirit. It is insoluble in water, sparingly soluble in cold alcohol, and readily soluble in hot alcohol and oils. Commercial spermaceti consists of a small quantity of a liquid oil and cetine, a neutral and beautifully crystalline body, having the composition $C^{64} H^{64} O^{4}$.

Actions and Uses.—Spermaceti is an emollient and demulcent, is rarely given internally, but is frequently used as an ingredient of ointments and liniments.

STARCH.

Amylum. $C^{12} H^{10} O^{10}$.

Starch is present in large amount in all the cereal grains, in the stems of many plants, and in most roots. It is easily got from any of these sources, by bruising the plants, washing them, allowing the starch thus removed to subside, and then drying it. For commercial purposes, starch is prepared from coarse wheat-flour, rice, or potatoes ground to a pulp, and either allowed to ferment until acetic acid is formed, or treated with a diluted

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alkaline solution. The albuminous matters are thus dissolved, while the starch and lignine which subside from the fluid may be separated by washing the mixture in a sieve. Starch is insoluble in cold water, forms a gelatinous mass with boiling water, and is converted first into dextrine or British gum, and then into sugar, by diluted sulphuric acid, by a temperature of 300°, or by various animal matters. Starch consists of minute granules, varying in size in specimens got from different sources. Its most distinctive test is the blue compound it forms with iodine.

Actions and Uses.—Starchy substances are easy of digestion, and when given with a sufficiency of albuminous matters are also very nutritive; but, like the other proximate principles, they cannot alone support life. As demulcents and emollients, they are inferior to albuminous and mucilaginous substances, but like them are used for sheathing, protecting, and softening irritable surfaces. Thus, in diarrhœa and dysentery, they are advantageously given in the form of gruel, both by the mouth and rectum, either alone or with opium or astringents. Starch is sometimes applied in the dry state to improve the quality, and diminish the quantity of discharges from wounds, and with about one-eighth part of alum to arrest the flow of synovia from open joints. It is also occasionally used for mixing up medicines, and sometimes as a vehicle for administering them.

SUGAR.—MOLASSES.

CANE-SUGAR. Saccharum. Prepared juice of *Saccharum Officinarum.*

TREACLE. Sacchari fæx. Concentrated uncrystallizable juice of *Saccharum Officinarum.*—(Ed. Phar.)

Nat. Ord.—Graminaceæ. *Sex. Syst.*—Triandria Digynia.

Sugar is present in many plants, but seldom in such large proportion as to be worth extraction. In France it is prepared from beet-root, and in America from the *Acer Saccharinum*, or sugar-maple; but almost all the sugar used in this country is got from the sugar-cane. This plant, which is extensively cultivated in the West Indian colonies, has a perennial root, a jointed, annual stem, from six to twelve feet high, and long grassy leaves, which send out a flowering stem terminating in a panicle of beautiful silver-grey flowers. The lower parts of those canes which have not previously borne flowers are richest in saccharine matter. The canes are crushed between heavy rollers, the pale-green expressed juice, which is very prone to ferment, is then mixed with lime and concentrated, when yellow-brown crystals of raw sugar are formed, and there remains a variable quantity of a brown, uncrystallized substance, known as treacle or molasses. The raw brown or muscovado sugar of commerce, when brought to this country, is dissolved in water, heated with bullock's blood, and sometimes with alumina, filtered through animal charcoal, concentrated in vacuo at about 150°, poured into conical moulds, and, when solidified, forms the ordinary loaf or refined sugar.

Pure sugar is colourless, odourless, of a shining crystalline appearance, a density about 1500, and soluble in about half its weight of water at 60°. It phosphoresces in the dark, is decomposed by mineral acids, and readily fermented by yeast. Sugar, when slowly crystallized by suspending threads in a watery solution, to which a little alcohol has been added, forms sugar-candy. When heated, it loses its property of crystallizing, and if run into little moulds, forms barley-sugar. When exposed to a high temperature, it loses its sweet taste, acquires a dark colour, is then known as carmel or burnt sugar, and is used for colouring wines and spirits. Cane sugar, when crystallized, consists of $C^{12}\ H^{11}\ O^{11}$.

Grape sugar, *glucose*, *sugar of fruits*, *honey*, *or diabetic sugar*, is found in most plants, and is the variety of sugar formed from starch, whether in or out of the body. It is less sweet and less soluble than cane-sugar. It crystallizes in indistinct, warty, granular masses, and is not blackened by strong sulphuric acid, which readily chars cane-sugar. When treated with sulphate of copper and caustic potash, and heated, the bluish-green precipitate first formed rapidly becomes bright red, depending on the deoxidation of the oxide of copper, and the formation of the red sub-oxide. The supernatant liquid also becomes colourless. With cane-sugar, on the other hand, the bluish-green precipitate first formed undergoes little change, and the solution still retains its blue tint. This is a convenient test for distinguishing between the two varieties of sugar, and also for discovering the presence of sugar in urine and other secretions, in which it exists in the form of grape-sugar. Grape-sugar, when crystallized, has the composition $C^{12}\ H^{14}\ O^{14}$.

Milk-sugar, or *lactine*, is easily obtained from the homœopathic chemists, who use it extensively for subdividing their medicines. It is usually prepared from whey, occurs in hard, fibrous, crystalline masses, is gritty, less sweet than either of the preceding varieties, requires for solution five or six times its weight of water, and is not directly fermentable. It has the composition $C^{12}\ H^{12}\ O^{12}$.

Actions and Uses.—The sugars are important nutritive bodies, and are chiefly employed in the system in supporting animal heat. It is said that they destroy such creatures as frogs, leeches, and earth-worms; cause stupefaction in fishes; and in quantities of four or five scruples produce in pigeons swelling of the head and convulsions. But the injurious effects which sugar has on these animals has probably been exaggerated, for Hertwig mentions that pigeons consumed from five to ten scruples without any bad consequences. In the higher animals large doses of sugar (in horses one or two pounds, in dogs from eight to twelve ounces) increase the amount and fluidity of the feces, and also usually augment the secretion of urine. Sugar is used in man as a demulcent and emollient in the dry stages of catarrh; is occasionally given, though with little advantage, in poisoning with salts of mercury and copper; and is sometimes used as a domestic remedy for sores, and for removing spots on the cornea. On account of its antiseptic properties, it is much employed for preserving various vegetable, and some soft animal substances, and for making up various kinds of medicines. The simple syrup, the chief pharmaceutical preparation of sugar, is made by mixing, with the aid of gentle heat, three parts by weight of sugar and one of water, and clarifying the mixture with white of egg.

MOLASSES or TREACLE, the uncrystallizable portion of the sugar-cane juice, has a dark brown colour, a pleasant, sweet taste, and a density of about 1400. It is a mild laxative, and is especially valuable for expediting the action, preventing the nauseating effects, and covering the disagreeable flavour of many active cathartics. Where large doses of physic have been previously given, and their repetition is inexpedient, large and repeated doses of treacle will be found of much service in accelerating and increasing the action of the bowels, especially in cattle and sheep. It is a palatable, digestible, laxative article of food, and consequently well adapted for convalescents. Like sugar, it is antiseptic, and is one of the best excipients for making ball masses, giving them a proper consistence, and preventing their becoming dry, hard, or mouldy.

Doses, etc.—The dose of treacle, as a laxative for horses and cattle, is about ℔i.; for sheep ℥iij. or ℥iv., and for dogs ℥i. or ℥ij., given to all animals, at short intervals, until its effects are produced.

SULPHUR.

Brimstone. S.

Sulphur is a chemical element, and one of the most ancient articles of the materia medica. It is obtained by decomposing metallic sulphurets, or more conveniently by purifying the crude Sicilian sulphur which occurs in large beds as a product of volcanic action. The purified sulphur is sometimes met with in rolls, which are prepared by distilling or fusing the crude article, and running it into moulds; and sometimes in a finely divided impalpable and minutely crystalline powder, known as sublimed sulphur, or flowers of sulphur, and prepared by subliming crude sulphur, and introducing its vapour into a large closed chamber where it is condensed.

Properties.—Sulphur in mass is an opaque brittle solid, of a yellow colour, varying in tint according to the degree of heat to which it has been exposed during fusion. It has a faint peculiar odour, very little taste, a greasy surface, and a shining crystalline fracture. It is a bad conductor of heat, and hence, when grasped in the warm hand, crackles, and sometimes splits into fragments. It is insoluble in water, but in a state of fine division is dissolved in alcohol, ether, and the fixed and volatile oils. It has a specific gravity of 1·98, is inflammable, and burns with a pale blue flame, evolving sulphurous acid. When heated it exhibits curious properties, and passes through various allotropic conditions. At 212° it melts, becoming as fluid as water and of the colour of amber. At a higher heat it thickens, and becomes as dark as treacle. At 480° it is very tenacious and adheres to the vessel even when the latter is inverted; while from that temperature to 788°, at which it boils, it again becomes thin, and recovers in great part its original colour. Sulphur is usually of sufficient purity for all medicinal and pharmaceutical purposes. Traces of arsenic are, however, sometimes present in that made from pyrites.

Sulphur vivum, also called *sulphur caballinum*, or horse sulphur, is the residue left in the subliming pots. Some practitioners prefer it to the purer variety; but it must be used with caution, as, besides other impurities, it is apt to contain small quantities of arsenic.

Actions and Uses.—Sulphur is in very large doses an irritant; in medicinal doses a laxative and general stimulant of all the mucous surfaces; and when applied externally, an efficacious remedy for many skin diseases.

When given to horses in doses of a pound, it causes colic, purging, prostration of strength, and sometimes fatal gastroenteritis. (Moiroud.) A horse affected with glanders received doses beginning with an ounce, and gradually increased by additions of an ounce daily, until the sixteenth day, when the animal had got 136 ounces. Diarrhœa supervened on the seventh day, the appetite remained throughout unimpaired, the urinary secretion unaffected, and the pulse and breathing normal. On the third day the perspiration smelt of sulphur, and a bit of paper moistened with acetate of lead, and laid on the skin, became grey. The muco-purulent discharge from the nostrils increased daily; and the patient, though well fed, became gradually emaciated, and so reduced in strength, that by the seventh day he was unable to rise. After the tenth day the blood, even in the arteries, became very dark coloured, and also very thin and slow to coagulate. On the seventeenth day the animal was destroyed. The mucous lining of the stomach, colon, and cœcum, was of a reddish-blue colour, soft, and easily torn. The lungs, muscles, and intestinal contents, smelt strongly of sulphuretted hydrogen, but the blood had no such odour. (Hertwig.) Like most other non-metallic elements, sulphur is speedily converted within the body into a soluble hydracid, which readily enters the circulation, exercises a topical stimulant effect, especially on the mucous surfaces, and from its disagreeable odour, is readily detectible in most of the secretions and excretions, as the breath, perspiration, and feces. Waldinger mentions that a small quantity of sulphur, given for some time to sheep, imparted a very disagreeable flavour to the flesh.

As a laxative, sulphur is frequently given to cattle and sheep for the purpose of gently opening the bowels, or of keeping up the action of more powerful purgatives. In chronic pulmonary disorders, in rheumatism, in convalescence from most acute diseases, and in most skin affections, whether occurring in horses, cattle, sheep, or dogs, sulphur is of much service in promoting the healthy action of the bowels, skin, and kidneys, and is usually administered along with saline purgatives, a little nitre, or treacle. In such cases it is said to act as an alterative; and the term, though in itself very meaningless, may be retained, as indicating, in a single word, a gentle stimulant action, operating especially on the processes of secretion, and gradually improving the general health. Its efficacy as a vermifuge, though often extolled, is probably over-estimated. It is a popular preventive of distemper, as well as of a host of other canine disorders; and its mystic influence is believed to be exerted by keeping a bit of roll-sulphur in the water which the animal drinks. Whatever may be the medicinal or prophylactic effects of sulphur when properly administered, it can certainly be of no benefit when used in this way, for it is quite insoluble in water. The sudorific effects of sulphur are scarcely observable amongst the lower animals. It is much used among all the domesticated animals as a remedy for mange, scab, ring-worm, and such like scaly skin diseases; and in these cases is applied both internally and externally. The latter is, however, the more effectual mode of application, removing the itchiness almost immediately, and perfecting a cure in eight or ten days. The manner of its operation is still uncertain. It acts as a stimulant, bringing the diseased parts into a more healthy state, and probably also destroys the minute *acari* which appear to cause, or at all events greatly to aggravate, several of these skin diseases. But, in the speedy and effectual cure of such cases, it is of importance not only to employ sulphur applications, but also to make diligent use of soap and water, to pay scrupulous attention to cleanliness, and to alternate the medicinal remedies at short intervals, using in turn sulphur, chloride of lime, oil of tar, and mercurial ointment. Even the most obstinate and inveterate cases of mange will soon yield to such medicines when thus frequently interchanged, and aided by hygienic treatment.

Doses, etc.—The dose of sulphur, as a laxative for the horse, is ℥iij. to ℥iv.; as a so-called alterative, about ℥i. For cattle, as a laxative, ℥v. or ℥vi.; as an alterative, ℥i. or ℥ij. For sheep, as a laxative, ℥ij.; as an alterative, ʒvi. For the dog, as a laxative, ʒvi.; as an alterative, ʒi. to ʒij.

It may be administered, either made up in a bolus, suspended in gruel, or dissolved in oil. When used as an alterative, it is usually given in combination with saline matters, antimonials, or mercurials. The following prescription is often used for both horses and cattle:—Sulphur, ℥i.; tartar emetic, ʒi.; nitrate of potass, ʒij.

Very many preparations of sulphur are used externally, and almost every practitioner has his own formula. The simple ointment consists of one part of sulphur, or sulphur vivum, and four parts of axunge. One part of mercurial ointment is often added, and occasionally a little white hellebore; but the addition of this irritant body is not to be commended, being apt to cause vesication, especially in dogs. If used at all, the quantity should not exceed one-eighth or one-sixth part. Sulphur liniments are made in the same way as the ointments, merely substituting oil for lard. The simple liniment consists of one part of sulphur, and four parts of linseed-oil, or any other convenient excipient. The addition of one part of oil of tar, or of Barbadoes tar, is often advisable.

SULPHURIC ACID.

Oil of Vitroil. Acidum Sulphuricum. SO^3.

Sulphuric acid is prepared by burning sulphur so as to form sulphurous acid (SO^2), which is introduced into large, airy, leaden chambers, where it is oxidised by nitrous acid evolved from burning nitre. Sulphuric acid (SO^3) is thus produced, and is dissolved in water admitted into the lower part of the chambers. This diluted solution is then concentrated, first in lead, and then in platina vessels.

Properties.—Strong sulphuric acid is a dense, oily looking, colourless, odourless, corrosive liquid, with an intensely acid acrid taste, and a density of 1845. It freezes at 36°, and boils at about 600°; readily absorbs moisture from the air, and hence if kept in unstoppered vessels speedily becomes diluted. When brought in contact with any of the soft animal tissues it abstracts their fluid parts, coagulates their albumen, and, if concentrated, chars them. It is miscible with water in all proportions; and, in combining with it, undergoes a slight diminution in volume, and evolves much heat. When diluted, it rapidly dissolves such metals as iron and zinc, and when heated with alcohol produces ether. It is decomposed by charcoal, phosphorous, and various other substances, which unite with part of its oxygen, and thus cause the evolution of sulphurous acid. It possesses, in a marked degree, all the properties of a mineral acid, having an acid taste, turning vegetable blues red, and browns yellow, and uniting with bases to form salts. It is easily distinguished by its forming with soluble salts of barium an abundant white precipitate, which is insoluble in other acids.

Anhydrous sulphuric acid, a white crystalline body, consists of one equivalent of sulphur, and three of oxygen. The strongest acid of the shops contains one equivalent of this anhydrous acid, and one of water; and the Saxon or Nordhausen acid, a dark-brown fluid, got by distilling iron pyrites, and used in the dye-works for dissolving indigo, contains two equivalents of anhydrous acid, and one of water.

Impurities.—Water, organic matters, sulphate of lead, and nitrous acid, are the most common impurities of sulphuric acid, and sometimes render it unfit for chemical and pharmaceutical purposes. The three first of these impurities may be got rid of by distillation, which may be conducted with perfect safety if a few fragments of platina be placed in the retorts; and the last by adding to every f℥viij. of the acid about grs. xv. of white sugar, heating the mixture for two hours, and distilling. The following tests of the Edin. Phar. guard against all the ordinary impurities of sulphuric acid—"Density, 1840, or near it; colourless; when diluted with its own volume of water, only a scanty muddiness arises, and no orange fumes escape. When diluted with twelve volumes of water, sulphuretted hydrogen causes a white muddiness, but not a yellow precipitate."

Actions and Uses.—Sulphuric acid, when used internally, is irritant, tonic, and astringent; and when used externally, irritant, caustic, and astringent.

In poisonous doses it causes, in all animals, corrosion of the mucous membranes of the mouth, blackening of the teeth, feebleness and irregularity of the pulse, and great prostration of strength. After death, the contents of the stomach are usually very acid, the alimentary canal studded in various parts with black spots, and the blood in the surrounding vessels coagulated. The appropriate chemical antidotes are bicarbonates of the alkalies, chalk, and magnesia. Mild diluents, as oil, milk, and gruel, should also be given.

Sulphuric acid, when used medicinally in any considerable amount, is not, as has been supposed, neutralized by the intestinal secretions, but is absorbed as an acid into the blood;[1] and this appears evident from the fact that acids and their salts are not identical in action, which would certainly be the case if acids, previous to their absorption into the blood, were converted into salts. Further, it is shown that the small quantity of alkali present in the intestinal canal, is quite insufficient to neutralize the doses of acid usually given. The changes which sulphuric acid produces, on its getting access to the blood, are as yet unknown. It usually, however, diminishes thirst, and when given for some time continuously is astringent and tonic. It is, in consequence, used with much benefit, and for all animals, in cases of feebleness and atony; during convalescence; and, in short, in all cases where mineral tonics are indicated. It has, of late, been much used in cases of pleuro-pneumonia amongst cattle, and seems often of good service in reducing the pulse, relieving the breathing, and sustaining the vital powers. Its success, however, is by no means invariable, nor is the per-centage of recoveries much greater than when other modes of treatment have been adopted. In these cases, about an ounce daily was the average dose; but two, and even three ounces, were often given with impunity. Repeated large doses, however, often cause diarrhœa and colic. Some practitioners recommend it as a tonic.

Sulphuric acid, when applied to the skin, combines with its moisture, bases, and albuminous matters, and causes disorganization of the cuticle, and considerable pain, owing to the exposure of the nervous fibrillæ. On account of its fluidity, and the consequent difficulty of circumscribing its effects, it is unsuitable for some of the purposes of a caustic, but is well adapted for cauterising irregular, sinuous, and poisoned wounds, and for most of the uses of a styptic and astringent. It is supposed to

[1] Prize Essay on the Action of Medicines, by F. W. Headland, B.A., page 109.

increase the potency of many blistering ointments, but unless in small amount is apt to cause blemishing. A few drops of sulphuric acid are often given along with Epsom salt and other saline purgatives, to diminish their disagreeable taste.

Doses, etc.—The dose of sulphuric acid for the horse is ʒi., repeated several times a day; for cattle, from ʒij. to ʒiv.; and for dogs from ♏ij. to ♏iv. It is best given with water alone, taking care to dilute it, so that it does not cause injury of the mouth or throat. A suitable solution, for external use as an astringent, may be made by dissolving from ten to twenty drops of acid in an ounce of water.

SULPHUROUS ACID.

Acidum Sulphurosum. SO^2.

When sulphur is burned in air or oxygen, it forms suffocating fumes of sulphurous acid—a colourless gas, which is soluble in water, reddens litmus, bleaches colouring matter, but not permanently, like chlorine, extinguishes flame, and is irritating and irrespirable. It speedily destroys plants, even when much diluted, and in large doses acts on animals as an irritant poison. It has sometimes been used as a remedy for skin diseases in the form of baths; but the practice, which has been chiefly confined to the continent, requires that much care be taken to prevent the gas being respired. It is a very effectual deodoriser and antiseptic, and is extensively used for preventing the putrefaction of the gelatine used in paper-works, for destroying the foul effluvia of the cochineal dye-works, and for arresting the souring of many of the lighter continental wines. Its pre-eminent efficacy for these purposes is a very strong argument in favour of its possessing disinfectant properties. But positive proof of the existence of such properties is still wanting, and from the nature of the subject can only be procured with great difficulty. For deodorising or disinfecting purposes, sulphurous acid is conveniently obtained by burning sulphur on a shovel of coals. It is so irritant that it can only be freely and effectually used in habitations from which all animals have been previously removed. It should be employed along with chlorine. Great care should, at the same time, be paid to cleanliness and thorough ventilation.

SWEET SPIRIT OF NITRE.

SPIRIT OF NITROUS ETHER. Spiritus ætheris nitrici. A solution of one volume of hyponitrous ether in four of rectified spirit.

HYPONITROUS OR NITROUS ETHER. Æther nitrosus. $C^4 H^5 O + NO^3$.

Hyponitrous ether, though of little importance on its own account, demands notice as the chief ingredient of that useful compound, sweet spirit of nitre. It is a pale-yellow, volatile, inflammable, mobile fluid, with a sweet, warm, etherial taste, and a peculiar, penetrating, fragrant odour, resembling that of rennet apples. Professor Gregory, in the last edition of his "Handbook of Organic Chemistry," says :—

"It is best prepared in a state of purity when a current of hyponitrous acid vapours, derived from starch and nitric acid, is passed through weak alcohol, the product being condensed in Liebig's refrigeratory. The ether is washed with water, and dried by means of chloride of calcium. The whole apparatus must be kept cold, otherwise the action is too violent, and the results very complex. When nitrous ether is made by the usual processes, in which ordinary nitric acid is mixed with alcohol, the product always contains a large proportion of aldehyde, and, in fact, very little of the true ether."—P. 194.

The Edinburgh Pharmacopœia gives the following directions for the preparation of hyponitrous ether, and its subsequent conversion into sweet spirit of nitre :—

"Take of rectified spirit, two pints and six fluid ounces; pure nitric acid (1500), seven fluid ounces; or nine fluid ounces of commercial acid, density 1380. Put fifteen fluid ounces of the spirit, with a little clean sand, into a two pint mattrass fitted with a cork, through which are passed a safety-tube terminating an inch above the spirit, and another tube leading to a refrigeratory. The safety-tube being filled with pure nitric acid, add through it gradually three fluid ounces and a half of the acid. When the ebullition, which slowly arises, is nearly over, add the rest of the acid gradually, half a fluid ounce at a time, waiting until the ebullition caused by each portion is nearly over before adding more, and cooling the refrigeratory with a stream of water iced in summer. The ether thus distilled over, being received into a bottle, is to be agitated first with a little milk of lime, till it ceases to redden litmus paper, and then with half its volume of a concentrated solution of muriate of lime. The pure hyponitrous ether thus obtained, which should have a density of 899, is then to be mixed with the remainder of the rectified spirit, or exactly four times its volume.

Spirit of nitric ether ought not to be kept long, as it always undergoes decomposition, and becomes at length strongly acid. Its density by this process is 847."—(Ed. Phar).

In order to prevent tumultuous ebullition, violent succussions, and liability to explosion, the precautions above mentioned must always be carefully observed. Sand must be placed within the mattrass, a powerful refrigerator and proper safety-tube must be employed, and the acid added slowly and gradually. The changes occurring within the mattrass are very complex, and many different substances are evolved ; but the important stages in the process are—the production of ether ($C^4 H^5 O$) by the dehydratising of the alcohol ($C^4 H^5 O + HO$) ; the formation of hyponitrous acid (NO^3) by the deoxidation of the nitric acid (NO^5) ; and the subsequent union of the two products to form hyponitrous ether ($C^4 H^5 O + NO^3$). This is afterwards mixed with milk of lime to neutralise free acid, agitated with chloride of calcium to remove alcohol and water, and then diluted with four volumes of rectified spirit, when it constitutes the sweet spirit of nitre. According to the directions of the London College, the preparation is sometimes made at once by distilling the acid with the whole of the spirit ; but when thus made, it is apt to be of irregular strength.

Properties.—The properties of sweet spirit of nitre are similar to those of nitrous ether, but vary somewhat with its strength. It is almost colourless, has an etherial apple odour, and a sweet, warm, spirituous taste. When freshly prepared, it should be neutral, but when kept, gradually becomes acid, both to test-paper and to the taste, owing to its being resolved into ether and hyponitrous acid—a change especially apt to occur in very strong or carelessly prepared specimens. The density of the sweet spirit of nitre of the Edinburgh College is 847; that of the London, 834; and that of the Dublin, 850. The Edinburgh preparation is two, or perhaps three times stronger than the London. (Christison).

Impurities.—Sweet spirit of nitre is very liable to adulteration. Indeed, though it should be of uniform quality, there are sold in the shops three different kinds, at prices varying with the per-centage of ether which they contain. The best test for determining the strength of sweet spirit of nitre, and its freedom from water or excess of alcohol, is to agitate it with twice its volume of concentrated solution of chloride of calcium, and observe the amount of ether which comes to the surface. In a good specimen of the Edinburgh preparation, this amounts to about 12 per cent.; but in a London specimen, seldom exceeds two. Excess of hyponitrous acid is discoverable by its reddening litmus paper; but this test is rather too delicate, and any specimen may be regarded as sufficiently free of acid, if it effervesces feebly, or not at all, with solutions of bicarbonate of potash or of soda. As mentioned by Professor Gregory, in the passage above quoted, all the sweet spirit of nitre of commerce contains a variable, but often considerable, quantity of aldehyde.

Actions and Uses.—Sweet spirit of nitre is stimulant, anti-spasmodic, diuretic, and diaphoretic.

In large doses, it acts like alcohol and sulphuric ether, as a narcotic, producing great depression and stupor, with little preliminary excitement. In all its other actions, it also closely resembles ether, but is somewhat less active as a stimulant and anti-spasmodic. During its excretion by the kidneys, it exercises its ordinary stimulating effect, exciting them to increased activity. This action is best ensured by administering the medicine along with a small quantity of nitre. Its diaphoretic action is somewhat more difficult to produce, for the medicine is very apt to be excreted by the kidneys rather than the skin, and the only way to prevent this is to keep the patient well clothed, and in a warm situation, and to give the sweet spirit of nitre in small and frequently repeated doses. Its uses are the same as those of sulphuric ether. It is a most valuable carminative and anti-spasmodic in indigestion, hoven, tympanitis, and colic; and a most effectual means of inducing reaction, and exciting the functions of the skin and kidneys in local congestions, typhoid affections, and convalescence from debilitating diseases. It is contra-indicated in acute inflammation and high fever.

Doses, etc.—The dose of sweet spirit of nitre as a stimulant and anti-spasmodic, is for horses, f℥i. or f℥ij.; for cattle, f℥iij. or f℥iv.; and for dogs, about f℈i. It is best given diluted with water, and when used as an anti-spasmodic, should be united with opium.

TOBACCO.

Tabacum. Leaves of *Nicotiana Tabacum.* (Edin. Phar.)

Nat. Ord.—Solanaceæ. *Sex. Syst.*—Pentandria Monogynia.

Tobacco derives its name from *tabac*, the instrument used by the American aborigines for smoking the leaf, or, according to others, from the Island of Tobago, or from the town of Tobasco in New Spain. It appears to have been known and cultivated from time immemorial by the natives of America; and is still grown largely on that continent, especially about the great river Orinoco, and in the United States. It was unknown in the Old World, at all events, in Europe, until after the discoveries of Columbus, and was first introduced into England by Sir Francis Drake in 1586.

Natural History.—The *Nicotiana Tabacum*, which yields the Virginian and several others of the more important commercial tobaccos, is a herbaceous plant which has a branching fibrous root, a tall annual stem, funnel-shaped rose-coloured flowers, and large, moist, clammy, brown leaves with yellow spots, glandular hairs, a strong peculiar narcotic odour, and a nauseous bitter taste. They readily communicate their properties to hot water and alcohol. The plant is cut down in the month of August, and the leaves, which are the officinal part, are dried, twisted, and carefully packed, with great compression, in hogsheads. It would be needless here to notice the different sorts of tobacco, which owe their several peculiarities chiefly to the manner in which they are prepared for sale. The Virginian tobacco, being the strongest, is generally preferred for medicinal purposes. Snuff is prepared by cutting tobacco into small pieces, piling it into heaps, and pouring water over it to encourage fermentation. The heaps speedily heat, and evolve ammonia, and the process continues from one to three months, according to the sort of snuff required. The fermented product is then ground and sifted.

The ordinary varieties of commercial tobacco contain about 12 per cent. of moisture, from 40 to 44 per cent. of matters soluble in cold water, from 2·5 to 4 of matters insoluble in cold water but soluble in boiling water, and from 40 to 45 of ligneous materials and insoluble salts.[1] Fresh tobacco leaves contain :—

Nicotina or nicotine (C^{10} H^{8} N), . .	0·06
Concrete volatile oil (Nicotianin), . .	0·01
Bitter extractive matter, . . .	2·87
Gum, malic acid, with malate of lime, .	2·24
Chlorophyll, ...	0·26
Albumen and gluten, . . .	1·30
Lignine, and a trace of starch, . .	4·65
Salts and silica, ...	0·70
Water, ...	88·28
	100·37

In this analysis, made by Posselt and Reimann, in 1827, the two first-mentioned substances are the active principles of the tobacco. *Nicotina* is a liquid, oily, volatile alkaloid, with a slight odour of tobacco, and a most acrid burning taste. It is miscible with water, alcohol, and ether, and constitutes from 2

[1] Analyses of tobacco made by the Analytical Sanatory Commission.—Lancet, 13th August 1853.

to 10 per cent. of the dried leaves. It is very poisonous, half a grain being sufficient to destroy an ordinary-sized dog. It may be got by distilling a concentrated infusion of the leaves, with potash, adding sulphuric acid, and dissolving out the sulphate of nicotina by alcohol. *Nicotianin* is a solid, camphoraceous, volatile oil, having the odour of tobacco without its acridity, and readily producing convulsions, coma, and death. It is insoluble in water and diluted acids, but is soluble in ether and caustic potash. It is easily got by distilling the leaves with water, when it comes over and swims on that liquid.

Actions and Uses.—Tobacco is a narcotico-acrid poison ; and is used medicinally as a sedative, antispasmodic, and anthelmintic, as well as an auxiliary emetic and cathartic. It is besides a useful remedy for freeing the skin of various diseases, and almost all kinds of parasites.

Its primary irritant action is illustrated in the stimulant effect it exerts on the nostrils and salivary glands of man, and the vomiting and purging which follow its administration to the dog. Its secondary sedative and narcotic actions are exhibited when it becomes absorbed in sufficient quantity from any mucous, cutaneous, or other vascular surface, and thus finds entrance into the blood. Hertwig appears to have investigated the action of tobacco on the lower animals with much care. He gave horses the powdered leaves in doses varying from half an ounce to an ounce, and found that the pulse was lowered from three to ten beats per minute, and was also irregular and intermittent ; and that a repetition of such doses caused increased evacuation both of feces and urine. Large doses, especially when injected into the veins, induced acceleration of the pulse, considerable irritation, loss of appetite, and in all cases increased activity both of the bowels and kidneys. Two ounces of powdered tobacco in a pound and a half of water, were given in divided doses, but within two hours and a half, to a healthy middle-aged cow, and produced heightened temperature of the skin, acceleration of the pulse from 65 to 70, quickened, but somewhat oppressed, breathing, coldness of the horns, ears, and extremities, dilatation of the pupil, and copious perspiration continuing all night. Next day, the animal continued dull, but on the third day she was perfectly well. An ox, after consuming about four pounds of tobacco leaves, speedily became very restless, ground his teeth and groaned, lay with outstretched limbs and distended rumen, passed quantities of thin, fetid feces, and died in eleven hours, in convulsions. Quantities of the leaves were found in the alimentary canal, and the mucous membrane, especially of the fourth stomach, was red and corroded, particularly where in contact with the tobacco. Hertwig further mentions that goats are similarly affected by doses of one or two ounces, and generally die in about ten hours. Orfila introduced five drachms and a half of powdered tobacco (rappee) into the stomach of a dog, and retained it there by placing a ligature round the œsophagus. There ensued violent efforts to vomit, nausea, purging, tremors of the extremities, giddiness, accelerated respiration, quicker and stronger action of the heart, convulsions, stupor frequently interrupted by spasms, and in nine hours death. A decoction containing half a drachm, injected into the rectum of a dog, produced most of the same symptoms, but did not prove fatal. Two and a half drachms, applied to a wound, destroyed a dog in an hour.

In poisoning by tobacco, death appears to depend on a perverted and paralysed state of the nervous centres, producing coma, syncope, or apnœa. This irregularity in the manner of dying, as well as the variety in the general effects of tobacco, seems to depend upon the fact that the drug owes its activity to two constituents, nicotina and nicotianin, which differ in their action, and occur in the different preparations of tobacco either singly or together. Both are present in the powder and solution, but the alkaloid is the chief active ingredient of the smoke, and hence the probable reason why that form of exhibiting tobacco is least irritating, most effectual in relieving spasm, and also in excessive doses most apt to induce convulsions and coma, without materially affecting the action of the heart.

Tobacco resembles digitalis in many of its actions, but has more effect in increasing secretion. Though nearly allied to the other *solanaceæ* (belladonna, hyoscyamus, and stramonium), it differs from these in causing contraction, instead of dilatation, of the pupils. Though resembling opium in its contracting the pupil, and relaxing muscular fibre, it is distinguished from it in as much as it induces more prominently the early symptoms of intoxication, acts less on the brain, and more on the heart, and increases the secretions as well of the skin as of all other parts.

On account of its irritant properties, it acts on dogs and other carnivora as an emetic ; but is not used for that purpose. From its relaxing muscular spasm, it is a very valuable remedy in colic, tympanitis, and hernia, and in these cases is most effectual in the form of smoke clysters. In enteritis and peritonitis it is also frequently of much benefit, chiefly on account of its anti-spasmodic and sedative virtues. In obstinate torpidity of the bowels, it is a most serviceable adjunct to active purgatives. It speedily poisons intestinal worms, and also hastens their expulsion, either dead or alive, by encouraging the action of the bowels, It is specially useful in cases of ascarides. It has been used in retention of urine and dropsy, but with doubtful success. By soliciting the action of the bowels it is often of much service in tetanus and other nervous diseases. It is used externally in the treatment of various skin affections, as mange in dogs, and scab in sheep ; and is also a potent remedy for the destruction of lice, fleas, and ticks. In all such cases, it must, however, be used with caution, since serious and even fatal effects have resulted from its absorption.

Doses, etc.—Tobacco is seldom administered by the mouth. When so used, the dose for the larger animals is about ʒiv. or ʒv. ; and for dogs, about grs. v. or grs. vi. As a clyster, it is employed either in the form of infusion or of smoke. The latter, however, is more safe and certain, and is most conveniently given by filling a common barrel syringe with smoke drawn from a tobacco-pipe. Three or four syringe-fulls are sufficient at a time, and may be repeated at intervals as required. For external application, or for enemata, the infusion should be made with about a scruple of tobacco to a pint of hot water. Solutions of greater strength are often dangerous.

TURPENTINES.

Terebinthinæ.

Nat. Ord.—Coniferæ. *Sex. Syst.*—Monœcia Monadelphia.

The natural family, *Coniferæ*, yields many important medicinal substances, as common and Venice turpentine, Canada balsam, frankincense, oil of turpentine, resin, tar, and pitch. All the trees of this family contain an oleo-resinous juice, which exudes spontaneously from incisions made into the stems and branches, and is easily separable by distillation into a volatile oil and a resin. The roots and other hard parts, when subjected to smothered combustion or destructive distillation, yield tar from which pitch is also prepared.

To prevent unnecessary recapitulation, I shall include all these substances under one head, and shall consider,—

I. The various sorts of turpentine—being the oleo-resinous juices of the *Coniferæ*.

II. The oil of turpentine—being the volatile oil procured from turpentine by distillation.

III. The various resins or rosins—being the residue of the distillation.

IV. Tar and pitch—being the substances got by subjecting the roots and branches of the *Coniferæ* to destructive distillation.

I. The various Sorts of Turpentine.

When these juices first exude from the tree they are fluid, or nearly so, but when exposed to the air they solidify, from the volatile oil being partly given off and partly oxidized. By the action of heat, however, they readily regain their fluidity. They have a peculiar taste and odour, are insoluble in water, but soluble in oils, alcohol, and ether; are inflammable, and leave, when burnt, a finely divided carbonaceous residue of lamp-black.

There are many varieties of turpentine, but the most important are common and Venice turpentines, Canada balsam, and frankincense.

Common Turpentine is brought principally from the United States of America, but also from Norway, and other northern countries of Europe. It is the produce of several species of pine, but especially of the *Pinus palustris*—a very large tree found in the southern parts of North America, having bright green linear leaves about a foot in length, and collected into bundles like those of the *Pinus sylvestris,* or Scotch fir, from which turpentine is also procured. It is usually obtained during the spring and summer months by making incisions in the lower part of the trunk, and removing two or three feet of the bark. The hollow thus made becomes filled with turpentine. The variety known as Bourdeaux turpentine is at present imported only in very small quantity. Common turpentine is generally semi-fluid, but its consistence varies considerably with the temperature and the length of time it has been kept. It has a yellow colour, an aromatic odour, and a warm pungent taste. Unless melted and strained, or, as it is technically called, *rectified,* it contains portions of leaves, twigs, and other impurities. Water has little effect upon it, and does not separate its active principles. The quantity of oil of turpentine it contains varies from five to twenty-five per cent. The American variety, when recent, is said to yield seventeen per cent.

Venice Turpentine (Terebinthina Veneta), as usually met with in commerce, is got from the *Larix Europea*—a lofty tree with graceful drooping branches, and leaves which are at first in fasciculæ, like the pine tribe, but afterwards become solitary by the elongation of the twigs. Holes are bored into the tree, wooden spouts attached, and the resinous juice thus obtained is purified by filtration. It is generally thick, tenaceous, and opaque, has a yellowish olive-green tint, an acrid bitter taste, and a peculiar terebinthinate odour, somewhat weaker, however, than that of common turpentine. It contains from fifteen to twenty-five per cent. of volatile oil. *Strasburg turpentine* is very similar to Venice turpentine, and is often confounded with it.

Most of the Venice turpentine of the shops is an artificial mixture of five ounces oil of turpentine with a pound of black rosin.

Canada Balsam, better known as balsam of Gilead, is the purest of all natural turpentines. It is chiefly obtained from the *Abies balsamæ*, and is found in vesicles lying between the bark and the wood. It is very rich in volatile oil, and is consequently more fluid than the common turpentines. It is yellow and transparent, with an agreeable odour, and a bitter and slightly acrid taste.

Frankincense, or Thus, is the turpentine got from the Norway spruce fir (*Abies excelsa*). It contains much resin, and little volatile oil, and hence is more solid than many substances of this class. It is of a yellow colour, firm and brittle, without odour, but having an acrid bitter taste. Concrete American turpentine is largely substituted for frankincense, especially in the preparation of *Burgundy pitch*, which is prepared either from the real or counterfeit article by fusion and pressure through a cloth, and occurs in soft, pale yellow masses, having a turpentine odour and taste. It contains a large proportion of resin, and but little volatile oil, and is chiefly used externally, and especially in the human subject, for making stimulant adhesive plasters for chest affections, rheumatism, lumbagoes, etc.

Actions and Uses.—The turpentines are topical irritants; and, when given internally, become speedily absorbed, act as general stimulants, and are discharged from the system by the kidneys, bronchial mucous membrane and skin, stimulating whatever parts are employed in their excretion. Their activity resides chiefly in the volatile oil, and hence those which contain most oil (that is, the most fluid ones), are the most active. In point of activity they may be arranged as follows: Canada balsam, Venice turpentine, common turpentine, and frankincense. Their medicinal uses are very various, and identical with those of oil of turpentine. They are given to all the domesticated animals as stimulants in indigestion, colic, and general debility; as laxatives, especially when in combination; and as anthelmintics, diuretics, and inspissants, of excessive mucous discharges. They are applied externally as mild stimulants, rubefacients, digestives, and styptics; but for all these purposes they are usually superseded by oil of turpentine.

Doses, etc.—The doses of the turpentines, for horses and cattle, vary from ℥i. to ℥ij., and for dogs from ℈i. to ℈iij. They are conveniently given with linseed or any other oil, or as emulsions made with treacle, albuminous substances, or about 1–20th part (by weight) of magnesia. For external application they are either used alone, or made into liniments with oil, or ointments with lard.

II.—Oil of Turpentine.

Oil of turpentine, often improperly called spirits of turpentine, may be got from any sort of turpentine, but is most usually obtained from the common white or American variety, by melting, straining, and distilling it with water. The oil passes over, leaving a resinous residue, and is purified by redistillation with water, or, still better, with aqua potassa. The oil is a clear, colourless, limpid, volatile fluid, with a powerful penetrating odour, and an aromatic bitter taste. Its spec. gravity is less than that of water, being about 860. It boils at 314°; is very inflammable, burning with a heavy yellow flame, and producing much smoke; is neutral to test paper; sparingly soluble in water; somewhat more soluble in alcohol; and readily dissolved in ethers and fixed oils. It is itself a valuable solvent for resins, fats, many alkaloids, resinous principles, India-rubber, and gutta percha, and might be economically substituted for alcohol in the making of many tinctures. When exposed to the air, it gradually thickens from absorption of oxygen. When moist, and reduced to a temperature of —17°, it deposits crystals. It is charred by sulphuric acid, and ignited by nitric acid or chlorine. It is believed to be a mixture of two isomeric oils; and when pure and freshly prepared is a hydro-carbon, having the composition $C^{10} H^{8}$ (or, according to some, a multiple of that, viz., $C^{20} H^{16}$). This is the radicle of many of the non-oxygenated volatile oils, as those of juniper, savin, copaiva, and lemons, and, with one equivalent of oxygen, forms camphor ($C^{10} H^{8} O$).

Actions and Uses.—Oil of turpentine is, in large doses, an irritant poison, and in medicinal doses is stimulant, antispasmodic, astringent, cathartic, anthelmintic, diuretic, and diaphoretic.

When injected into the veins of the horse it causes pulmonary inflammation and death. When given to the dog in doses of ʒij. it produces convulsions, tetanus, depression of the circulatory and respiratory functions, and causes death in about three minutes. (Schubarth). When less rapidly fatal it causes irritation of the alimentary canal, and general vascular excitement. In all such cases, the lungs are found much congested, and the stomach and intestines red and vascular. It also operates as an active poison on animals low in the scale of being, as lice and worms; and hence is very efficacious in destroying such parasites when inhabiting the intestines or skin of any of the higher animals. Its irritant action is but a higher degree of its stimulant action, and is the cause of most of its valuable therapeutic effects. When given internally it speedily becomes absorbed, and may be detected in various of the secretions and excretions, as in the chyle, breath, and sweat, which have in consequence a strong terebinthinate odour, and in the urine, to which it imparts the odour of violets.

Oil of turpentine is administered in many different diseases, and to all the domesticated animals. It is sometimes used as a stimulant in typhoid fever and general debility; but as its effects are very transient it must be given frequently. As an antispasmodic it is very efficacious in colic, tympanitis, and even in some cases of epilepsy. It enters into the composition of many colic drenches. That most commonly used at the college consists of linseed oil Oi., tincture of opium, f℥i. and oil of turpentine f℥i. The last of these ingredients may often be advantageously increased to f℥ij.; but must be withheld altogether in every case where there is the slightest evidence of inflammation. When given for some time continuously, it is believed by some to be a tonic; but its tonic action is not well established. In these circumstances, however, it often acts as a constitutional astringent, and hence is frequently effectual in arresting excessive mucous discharges, especially those from the respiratory and urinary membranes. In combination with other medicines, as aloes and castor oil, it is of much service in overcoming long-standing and obstinate constipation; but when given alone, except in excessive doses, its cathartic action is uncertain. It is one of the best of all anthelmintics; and for this purpose should be given with cathartics after a fast of several hours, and its administration followed up by turpentine enemata, which are especially useful in dislodging ascarides from the rectum. Besides being of great service in destroying worms infesting the alimentary canal, it is also an unfailing remedy for removing the filaria which at certain seasons appear in the bronchii of calves and young cattle, and give rise to symptoms resembling those of bronchitis. In such cases the usual practice is to pour a teaspoonful of turpentine into the nostrils, but this mode of administration is apt to cause undue irritation, and is not at all essential to the cure; for, on account of the rapidity with which the drug is absorbed, it is equally efficacious when given by the mouth, one or two doses, at intervals of a day or two, seldom failing in working a perfect cure. On account of its stimulant action on the kidneys, oil of turpentine is used for relieving suppression of urine and dropsies, especially those depending upon weakness, where inflammation has been entirely subdued, and where the effusion occurs independently of venous obstruction. As a diuretic, small and repeated doses (not exceeding f℥i.) are most effectual, especially if conjoined with a little nitre or other saline matters. Like most other diuretics, it causes, in excessive doses, so much irritation of the urinary organs as to arrest their secretions and produce inflammation. To develop the diaphoretic action of the oil, the patient should be kept in a warm place and well clothed.

Oil of turpentine is used externally as a digestive for wounds, a stimulant for chronic swellings and a counter-irritant. As a counter-irritant, it is not very suitable either for horses or dogs. When applied to the skin of the former animal, it causes almost immediately much restlessness and topical irritation, and if used largely or repeatedly is very apt to blemish. In cattle practice, however, it is often useful in hastening and increasing the activity of other vesicants, and is much used along with mustard.

ammonia, and similar substances, in cases of inflammation of the intestines, pneumonic affections, and chronic rheumatism. From the antipathy with which it is regarded by most insects, it is very useful in protecting all animals, and especially sheep, from the attacks of flies; and is also often used for the destruction of vermin infesting the skin.

Doses, etc.—The dose of oil of turpentine varies much with the purpose it is given to fulfil. In horses the dose as a stimulant and antispasmodic is f℥i. or f℥ij., as a diuretic from fʒiv. to fʒviij., as a cathartic and anthelmintic about f℥iv., with a small dose of castor or linseed oil. For cattle the doses for the above purposes are about the same as for the horse, or larger to the extent of one-fourth. For sheep and dogs the dose as a stimulant and antispasmodic is from ♏xxx. to fʒi.; as an anthelmintic the quantity may be increased to the extent of ʒiv., and given in combination in the manner above directed; and as a diuretic again reduced to ♏x. or ♏xv.

For internal administration it may be conveniently dissolved in any of the fixed oils, or made into an emulsion with the yolks of eggs, in the proportion of one yolk to every two drachms of the oil of turpentine. The mixture may be flavoured with some aromatic, and diluted with water to suit convenience. These forms may also be used for clysters. For external application the oil is often used alone, but there are also innumerable preparations of it, of which the simplest are generally the best. The following liniment of the London Phar. is a convenient stimulant. Soft soap ℥ij., camphor ℥i., oil of turpentine fʒxvi. To be shaken until mixed.

III.—Resin or Rosin.

Resin is the residue left from the distillation of the various sorts of turpentine, which separate when heated into two distinct parts—the volatile oil which distils over, and the solid resin which remains behind. Two sorts of resin are met with in commerce—black or fiddlers' rosin and yellow rosin. The former is got by distilling the turpentine either without water or until all the water first added is expelled; the latter, by adding from time to time fresh portions of water. The yellow resin, when kept in a state of fusion for some time, constitutes the resin used in medicine and pharmacy. It is yellow or brown, brittle, easily pulverised, more or less transparent, inflammable, of a faint turpentine odour, devoid of taste, and rather heavier than water. It is insoluble in water, partially soluble in alcohol, readily dissolved in ether and volatile oils; and unites with fats, wax, spermaceti, and alkalies. It is not, as some have supposed, a simple substance, but consists of pinic and sylvic acids, and a neutral resinous principle. Its ultimate composition is $C^{40} H^{30} O^{4}$. The proportion of the acids vary considerably with the temperature at which the resin has been prepared.

Actions and Uses.—Resin possesses, but in lesser degree, most of the properties of the turpentines; is occasionally used as a mild diuretic, in doses, for horses and cattle, of from ℥iv. to ℥vi.; and enters into the composition of many diuretic masses, serving the two-fold purpose of increasing their activity and their consistence. Applied externally it is slightly stimulant and astringent, and hence is used in stopping hemorrhages, and for imparting firmness and adhesiveness to stimulant plasters. The simple digestive ointment of the Pharmacopœias consists of resin ℥v., axunge ℥viij., bees-wax ℥ij., melted together at a gentle heat, and stirred constantly until cool.—(Ed. Phar.) It is much used as a mild stimulant for wounds, ulcers, blistered surfaces, and the like, and also for giving consistence to other ointments.

IV.—Tar and Pitch.

Tar or *Pix liquida* is a dark brown, thick, viscid liquid, procured by the destructive distillation either of coal or wood. The wood tar, the only sort used in medicine, is generally obtained by placing the roots and branches of any of the pine tribe in pits dug in the earth on a bank or inclined plane. Fire is applied, and the heaps covered over with turf. The tar thus produced runs into iron pots placed at the bottom of the pit, and is thence conducted by pipes into the barrels in which it is exported. Tar is a thick, tenacious, dark brown, or nearly black fluid, having a peculiar odour and a bitter taste. When exposed to the air it slowly dries up. It is soluble in ether and oils. Water, when agitated with it, dissolves out part of its volatile oil and creasote, acquires its odour and taste, and in this state constitutes *tar water*, once considered a very valuable article of the materia medica. The composition of tar is very complex. It is believed to contain modified resin, modified oil of turpentine, acetic acid, and water (Christison); and also creasote, parafin, and other products of the destructive distillation of vegetable matters. When heated, *oil of tar*, a reddish, limpid fluid, which is merely impure oil of turpentine, is given off; and if the process be pushed sufficiently far *pitch* is left—a black, bituminous substance, solid and brittle, with a shining fracture, and consisting of modified resin, and various matters produced during the decomposition of the wood.

Actions and Uses.—Tar was once used as a stimulant, diuretic, and diaphoretic; but is now scarcely ever used internally except by empirics. Some few practitioners, however, still extol it as a vermifuge. It is of much value when applied externally as a remedy in skin diseases in all the domesticated animals, and for this purpose is generally made into a liniment with oil, or an ointment with lard or wax. It is useful in cases of canker and thrush, for which it is often used with alum, sulphate of copper, sulphuric or nitric acids. When mixed with equal parts of some oleaginous matter, or with cow dung, so as to render it sufficiently soft, it forms a capital stopping for horses' feet, and is believed to stimulate the secretion of horn. It is very serviceable in foot-rot in sheep; and has the two-fold advantage of stimulating the parts and preventing the attacks of flies. It is much used for securing wounds, binding up broken horns, and making adhesive plasters.

Oil of Tar is used for many of the purposes of oil of turpentine; and, from the creasote and similar substances which it contains, is very useful in curing mange, scab, and other troublesome skin diseases.

Pitch is little used in veterinary practice, except as a mild stimulant in diseases of the feet, as in canker, thrush, and sand-crack in horses, and foot-rot in sheep, and as a convenient substance for giving adhesiveness to plasters.

VALERIAN.

Root of *Valeriana officinalis.*

Nat. Ord—Valerianaceæ. *Sex. Syst.*—Triandria Monogynia.

Valerian is found native in this and other European countries. The radicles, descending from a short tuberous root-stock, are the officinal part of the plant. They are about the thickness of a quill, two to six inches in length, and of a yellow-brown colour. They have a disagreeable penetrating odour, and a bitter aromatic taste, and readily yield their active principle to water and spirit. They contain woody and extractive matters, resin, and about one per cent. of a volatile oil, which yields, on distillation, an acid known as valerianic acid, and capable of uniting with various bases, as iron and zinc, to form salts—the valerianates—which are thought to possess the conjoined properties of their acid and the base.

Actions and Uses.—Valerian is a diffusible stimulant, antispasmodic, calmative, and anthelmintic. In its general action it resembles assafœtida, the other gum resins, and camphor. It has very little effect on either horses or cattle, even when given in doses of several ounces. It acts, however, with considerable energy on dogs and cats, causing giddiness, reeling about, and all the symptoms of intoxication. Its effects appear to depend on its absorption, and its action on the brain and spinal cord. It is occasionally given to dogs to allay nervous irritability, and to relieve chorea and epilepsy; but little dependence can be placed on it. When given for some time it is thought to improve the appetite, and produce many of the other effects of a tonic. On account of the pungent volatile oil it contains it is a vermifuge, although not a very certain or active one.

Doses, etc.—If used for horses or cattle, it may be given in quantities varying from two to four ounces. The dose for the dog is from ʒi. to ʒij.; and for the cat, from ℈i. to ℈ij. The medicine is given in powder or infusion several times a day; and as it is not very active, it may be advantageously conjoined with ginger, gentian, or camphor, or dissolved in spirit of ammonia, as is commonly done in human practice.

VERATRUM.

White hellebore. Rhizome of *Veratrum album.*

Nat. Ord.—Colchicaceæ. *Sex. Syst.*—Polygamia Monœcia.

The *Veratrum album* is indigenous to many parts of Europe, though not to this country. The rhizome, or underground stem, is the only officinal part of the plant. It occurs in cylindrical pieces several inches in length, to which the radicles occasionally remain attached. Its bark is dark coloured, and rough; and its internal structure, of a greyish-white colour, and fibrous or farinaceous, according to the stage of its growth. When dried, it has little odour, but retains its peculiar taste, which is at first slightly sweet, and afterwards bitter and acrid. Its properties are communicated to water and alcohol, and a decoction and vinous solution are both in use. Its active principle, an alkaloid, called *veratria,* will be noticed below.

Actions and Uses.—White hellebore is, in all animals, an active, irritant poison, and operates by whatever channel it is introduced into the body. It resembles colchicum, both in its physiological and therapeutic actions. It causes vomiting, purging, and inflammation of the intestines, accompanied by depression and irregularity of the circulation, and spasms of the superficial muscles. The best antidotes for it are demulcents and mild laxatives, with diffusible stimulants to counteract the depression of the heart's action. Astringent solutions, such as infusion of nutgalls, should also be given, as they form an insoluble compound with the veratria. It is emetic, purgative, and anthelmintic, but from its violence and uncertainty cannot be recommended for any of these purposes. Some veterinary authorities consider that hellebore "powerfully rouses the absorbent system into increased action" (Morton); and recommend it for chronic œdema of the legs, in doses of about one scruple for the horse, and three grains for the dog. Others use it as a sedative; and for this purpose it is highly spoken of both by Percivall and Morton, who prescribe it for horses, in doses of from grs. xx. to grs. xxx., repeated every four or five hours. For these purposes, its efficacy has, however, I think, been over-estimated; and unless used in combination, its actions are irregular, uncertain, and often violent.

It is applied externally in cutaneous diseases, for destroying vermin infesting the skin, and for smearing setons; but for these purposes it must be used cautiously, as it is apt to be absorbed and produce serious constitutional effects. Many employ it as an ingredient in blisters, but, unless added in small amount, it renders them very irritant and apt to blemish.

Doses, etc.—As a sedative, the dose for horses is about ℈i.; for cattle, ℈ij.; and for dogs, grs. ij. It is given either as a bolus, or dissolved in diluted alcohol, and is repeated at short intervals until some of the physiological actions of the drug appear. For external use, the ordinary preparations are the powder and an ointment, which may consist of one part of hellebore to four of lard.

VERATRIA is present in several plants belonging to the natural family *Colchicaceæ*, but especially in the Veratrum album and Veratrum sabadilla. The former of these has just been described; the latter, from which veratria is usually prepared, is very similar in its action. It is an American plant, with long grassy leaves; a flowing stem; a fruit of the size and appearance of monkshood, and formed of three dry red-brown follicles or seed-vessels, which are the officinal part of the plant.

It is unnecessary here to notice all the details of the process for obtaining veratria. The important steps are bruising the follicles—making a concentrated tincture—decomposing this by adding to it a large quantity of cold water—precipitating the veratria by excess of ammonia—and then washing and drying it. The alkaloid so prepared is not perfectly pure. It is a grey powder, with a most acrid bitter taste, and a powerfully irritant action on the nostrils, causing violent and uncontrollable sneezing. It is insoluble in water, but very soluble in alcohol. A solution in acetic acid gives a white precipitate with tincture of galls, and a red solution with sulphuric and nitric acids. It is believed to have the co osition C^{34} H^{26} N O^{6}.—(Gregory).

Actions and Uses.—Veratria is one of the most active of irritant poisons.

"Magendie found that one grain, in the form of acetate, killed a dog in a few seconds when injected into the jugular vein, and in nine minutes when injected into the peritoneum; and that the principal symptom in such rapid cases was tetanic spasm." (Christison on Poisons, p. 881). When given to dogs by the mouth (in doses of from one to two grains), it causes great uneasiness, nausea, vomiting, violent purging, slowness of respiration, and slowness and irregularity of pulsation, extreme prostration of strength, spasmodic twitching of the voluntary muscles, especially those of the extremities, and death usually amid tetanic convulsions. The antidotes are the same as those for white hellebore. In the human subject it has been used both internally and externally for various neuralgic affections, and in subacute rheumatism; but the experience of most practitioners is not very favourable to it. It has not as yet been used in veterinary practice. It is scarcely necessary to say that, from its great activity, it would require to be given with much caution.

WATER.

Aqua. Oxide of hydrogen. HO.

It is scarcely necessary to notice the physical properties of water. When pure it is a transparent, neutral, colourless, odourless, and almost tasteless fluid. It solidifies or freezes at 32°, boils at 212°, when it rises in vapour or steam, and also slowly volatilizes at all temperatures. It is an active solvent for many mineral and vegetable substances, and hence its extensive use in pharmacy. It consists of eight parts, by weight, of oxygen, and one of hydrogen. All natural waters hold in solution a variety of salts, gases, and traces of organic matter. When the saline ingredients are in large amount, exceeding 1-5000th part, the water is said to be *hard*. It is then unfit for many pharmaceutical and domestic purposes, is not in general so well liked by animals for drinking, and is apt to cause diarrhœa, and other derangements of the digestive organs, especially in subjects unaccustomed to it. When the salts do not amount to 1-5000th part, the water is considered *soft*, and the degree of softness of any water may be tolerably accurately judged of by the facility with which it dissolves soap. The most common and abundant constituents of ordinary water are,—common salt, and other chlorides; carbonate of lime, which, when in undue quantity, may be got rid of by boiling the water, when the salt of lime is deposited; and sulphate of lime, which may be removed by the addition of carbonate of soda. The gases dissolved are chiefly common air and carbonic acid. It is the presence of these which renders good drinking water so palatable and refreshing, and the absence of them which renders many waters, as rain and recently distilled waters, so flat and mawkish to the taste. Organic matters are often present in the waters of rivers and marshes, causing them to spoil speedily, and rendering them apt to produce diarrhœa and dysentery. Filtration through sand, charcoal, or gravel, will generally remove these organic impurities. *Mineral waters* are unfit for general use on account of their containing an undue proportion of mineral matters or gases, or from their being at a higher temperature than that of the locality in which they are found. In this country the most common mineral waters are those which contain iron.

Actions and Uses.—Water is an unfailing constituent of all living tissues, and is essential to the support of animal life. It constitutes a large proportion of almost all kinds of food, rendering them more easily digested and assimilated. In the form of drinks it allays thirst, and chiefly supplies the loss of fluid constantly taking place by the lungs, skin, and kidneys. But, besides serving these important dietetic purposes, water is also much used as a diluent, to increase the secretion of urine, and so lessen its acridity, to dilute corrosive and irritant poisons, and so diminish their potency, and to assist and maintain the action both of diuretics and purgatives. When tepid it is a convenient auxiliary emetic for the dog. It is *the* important constituent of most emollients; and is also itself a useful emollient, being applied for softening and moistening hard dry surfaces, and increasing their natural secretions. Lint or spongiopiline, saturated with water, is frequently substituted for poultices, and is often preferable to them, on account of greater cleanliness, and less tendency to irritate and injure the surrounding parts. Cold water is refrigerant in virtue of its abstracting heat, both in raising its own temperature and in volatilizing.

It is not often prescribed for veterinary patients in the form of a bath, except for ensuring cleanliness. Boiling water forms one of the most prompt and convenient of all counter-irritants, and is especially useful in cattle practice. To be truly efficacious it must be used scalding hot; and the best way of applying it, either to the chest or abdomen, is that recommended by Mr Barlow, namely, to envelop the parts from below upwards in several folds of thick woollen horse-cloths, and then to pour in on either side from above water from kettles brought with all speed from the fire. An intense and widely spread counter-irritation may thus be rapidly induced, which does not leave blemishing, even in the horse, and proves of inestimable advantage in pneumonia and pleurisy, colic, enteritis, peritonitis, and obstinate constipation both in horses and cattle. Water, both hot and cold, is extensively used as a solvent, and for this purpose often requires to be distilled, except when, as in Edinburgh, the natural water is very soft. The heating of water increases its solvent power over most salts and vegetable matters, but diminishes its solvent power over gases.

WAX.

Cera.

Wax is a constituent of many plants. It is extracted from them by the bee, which mixes with it another fatty matter, secreted by scales investing its own abdomen, and elaborates from the mixture those cells which constitute the honey-comb. This comb, after the removal of the honey, is fused in boiling water, strained, and poured into moulds, when it constitutes the yellow wax or *cera flava*. This has a dull yellow colour, a slightly sweet and pleasant taste, but no odour or greasiness. Large quantities of yellow wax are purified by melting it with steam, straining and then decolourizing it by exposure in thin ribbons for two or three weeks to air and sunshine. The yellow wax thus loses all colour and odour, and becomes white wax or *cera alba*. Wax is insoluble in water, but soluble in fixed and volatile oils, and in about twenty parts of boiling alcohol. It fuses at about 150°, and when pure burns with a bright white flame. It readily unites with fats and resins, but is imperfectly saponified by caustic alkalies. It contains one-fifth of cerotic acid or cerine, which is a volatile crystalline acid, melting at 171°; and four-fifths of melissic acid or myricine, which is readily saponified, dissolves in alcohol, melts at 147°, and consists of palmitic acid united with a basic principle.

Impurities.—The impurities occasionally present in wax do not materially interfere with its uses in veterinary practice. Adulterations with starch may be detected by iodine; resin by its separating on the addition of cold alcohol; fatty matters by their greasiness and fusibility; and inorganic matters by their remaining as a residue after the specimen is burnt or melted and strained.

Actions and Uses.—Wax is more difficult of digestion, and probably also less nutritive than fatty matters. When given for some time continuously it causes constipation, and hence is sometimes used to correct diarrhœa. Its chief use, however, is as an external application and a constituent of ointments, cerates, and plasters, to which it is added in order to impart consistence and stiffness, and prevent rancidity. Yellow wax, mixed with hog's lard, or any of the common fixed oils, is much used as a simple ointment, for preserving irritable parts from the action of the external air, protecting the sound skin from acrid discharges, and preventing corrosive or blistering applications extending their effects beyond the parts to which their action is to be limited. The proportion of wax to the fats or oils must be regulated by the required consistence of the ointment. One part of yellow wax to four of hogs' lard, or two and a half of olive oil, are the proportions recommended by the colleges.

ZINC AND ITS MEDICINAL COMPOUNDS.

Oxide of Zinc. Zinci oxidum. Zn O.

When metallic zinc is exposed to a red heat it unites with oxygen. This is the old method of preparing the oxide, and that still followed by the Dublin College. The other colleges, however, direct it to be prepared by decomposing a solution of the sulphate with carbonate of ammonia, collecting the precipitated carbonate of zinc, and exposing it to a red heat until it is deprived of its carbonic acid and water.

It is a colourless, tasteless, odourless powder, and is insoluble in water but soluble in most acids and alkalies. When heated it becomes yellow, but, if free from impurity, should lose its colour on cooling. The impure oxide of zinc found in the chimneys of the furnaces where the zinc ores are roasted, is now seldom used. The oxide, as well as the other preparations of zinc, is distinguished by giving, with hydro-sulphuret of ammonia, a white precipitate of sulphuret of zinc (Zn S), and with caustic potash a white precipitate of oxide, which is redissolved by excess of the alkali, but reappears on the addition of sulphuretted hydrogen.

Actions and Uses.—The salts of zinc are irritant, astringent, and tonic, and bear considerable resemblance to those of silver and copper. The oxide is seldom given internally, but is frequently used externally, being applied in the several forms of powder, solution, and ointment. The dose of the oxide for horses and cattle is from ʒij. to ʒiv.; and for dogs, from grs. x. to grs. xv.

CARBONATE OF ZINC. Zinci carbonas. Zn O, CO^2.

Carbonate of zinc is used in veterinary practice under the name of calamine—an ore of zinc which abounds in this and other countries, has a greyish-brown colour, and effervesces with acids. It is, however, of little importance, and might be easily dispensed with, as its actions and uses are identical with those of the oxide. An ointment made with one part of calamine, and four or five of lard, is occasionally employed.

SULPHATE OF ZINC. White vitriol. Zinci Sulphas. Zn O, $SO^3 + 7$ HO.

When sulphuret of zinc—the zinc-blende of mineralogists, and an abundant ore of zinc—is roasted, its metallic portion becomes converted into oxide, and its sulphur into sulphuric acid. The salt thus formed is removed by solution and crystallization, and, though usually containing traces of iron, and occasionally of lead and copper, is sufficiently pure for most veterinary purposes. This is the process commonly followed on the large scale, but sulphate of zinc may also be made of great purity by dissolving fragments of zinc in diluted sulphuric acid, and this is the process directed by the colleges.

Properties.—It is a transparent colourless salt, having a styptic metallic taste, and usually occurring in needle-like crystals resembling those of Epsom salt. In dry air it effloresces. It is dissolved in less than its own weight of boiling water, and in two and a half times its weight of water at 60°. When heated it melts in its water of crystallization, and at high temperatures is decomposed. Any impurities it occasionally contains do not interfere with its medicinal actions.

Actions and Uses.—It is irritant, and consequently emetic, and is also astringent and tonic. Like other metallic irritants, it may be given to horses and cattle in very large doses without much effect. Doses of several ounces have been given with impunity. When swallowed by dogs, it speedily causes vomiting; and, as it is thus rapidly removed from the stomach, large quantities may be given without permanent injury. Orfila found that seven and a half drachms were vomited in a few seconds, and produced no lasting bad effects. When the animals were prevented vomiting by a ligature on the œsophagus, much smaller quantities sufficed to destroy them in about three days, the stomach exhibiting after death symptoms of incipient inflammation. Thirty grains in solution, injected into the veins, depressed the action of the heart, and destroyed life in a few seconds. (Christison on Poisons). The emetic action of sulphate of zinc is remarkably prompt and full, but is seldom accompanied by such lasting depression as that of tartar emetic. In repeated doses it is readily absorbed, and has been detected in the spleen, liver, and urine. It does not, like lead or digitalis, exhibit any cumulative action. Half an ounce, given to two horses thrice a day for a fortnight, had no effect, but when the doses were increased to an ounce, repeated three times a day, the appetite became impaired, and nausea, with diuresis, supervened. (Veterinarian, 1844, p. 55). In frequent small doses, it acts as an astringent, drying up excessive discharges, especially from the alimentary canal; and is also a useful tonic. It is occasionally given to dogs to empty the stomach of undigested food, foreign bodies, or poisons; but is seldom used either as an astringent or tonic. In the lower animals, its power of arresting spasmodic diseases is not well established. It is much used externally for the many purposes of a mild escharotic, astringent, and desicant.

Doses, etc.—The dose as an emetic for the dog varies from grs. viij. to grs. xv.; and as an astringent and tonic for horses and cattle, from ʒi. to ʒiij.; and for dogs, from grs. ij. to grs. iij. As an emetic, it is given in solution; for other purposes, however, the solid form is preferable. It is applied externally in powder, and also in solution, which must vary in strength according to the purpose for which it is applied. A convenient preparation for most ordinary cases may be made with one part of the salt to twenty of water.

CHLORIDE OF ZINC. Butter of zinc. Zinci chloridum. Zn Cl.

Chloride of zinc is prepared by dissolving zinc or its oxide in hydrochloric acid, evaporating the solution to dryness, and fusing the residue. It is a greyish-white, waxy-looking, deliquescent substance, with an astringent metallic taste. It dissolves in water, alcohol, and ether, precipitates albumen, and decomposes hydro-sulphuret of ammonia.

Actions and Uses.—In large doses it is an irritant poison, and in medicinal doses is believed to be a tonic, but is not used internally. On account of its readily uniting with albumen, it is caustic, astringent, and antiseptic. As a caustic, it is generally considered as scarcely less powerful than butter of antimony; and is frequently used with success in the treatment of luxuriant granulations, unhealthy ulcers, and fistulæ. When freely dissolved in water, it is a useful stimulant, astringent, and antiseptic; and has, besides, been recommended as a valuable sheep wash for preventing attacks of the fly. Decomposing hydro-sulphuret of ammonia, it is a deodoriser, and also, according to some, a disinfectant. For most purposes, it may be conveniently used in the form of Sir William Burnett's Disinfecting and Antiseptic Fluid, every fluid drachm of which contains 25 grs. of chloride of zinc.

ACETATE OF ZINC. Zinci acetas. $Zn\,O, C^4\,H^3\,O^3$. Or $Zn\,O, \bar{A}$.

Acetate of zinc is more used in veterinary than in human medicine. It is prepared by dissolving zinc or its oxide in acetic acid, or more conveniently by decomposing a solution of sulphate of zinc by acetate of lead, when mutual decomposition occurs, sulphate of lead being precipitated, and acetate of zinc remaining in solution. The suitable proportions are about three parts of sulphate of zinc, and four of acetate of lead. The *white lotion* so much used in the practice of the Edinburgh Veterinary College, is a solution of acetate of zinc made by dissolving three quarters of an ounce of sulphate of zinc, and an ounce of acetate of lead in a pint of water, and clarifying the solution by decanting or filtering it.

Acetate of zinc, when separated from solution, occurs in odourless pearl-like, rhomboidal plates, which are of a disagreeable metallic taste, and readily soluble in water. It may be identified as a salt of zinc by the tests for that metal already mentioned, and distinguished from the other salts of zinc by the acetous odour it evolves when treated with sulphuric acid.

Actions and Uses.—Salts which owe their effects to a common base, and are of equal solubility, always resemble each other very closely in their general actions—a law which is strikingly illustrated in the great similarity observable in the effects of the different salts of zinc. The acetate of zinc is not used internally, but is often applied externally to promote the healing of wounds, to dry up excessive discharges depending on weakness and flaccidity, and to allay superficial inflammation. The watery solution is the only preparation in common use.

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